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Improved Machine Tools.

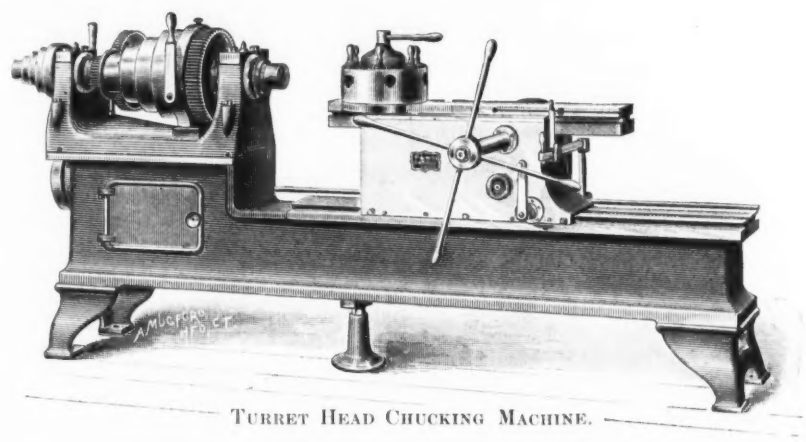
On this page we give some illustrations of some of the latest improved machinery brought out by The Pratt & Whitney Co., Hartford, Conn.

The first of these is an improved form of turret head chucking machine. Until recently these machines have been built with a gap in the bed to obtain the required swing, the gap in the improved form being dispensed with, and the turret-slide block made enough higher to give the same swing for the whole distance between the head-stock and the turret block, instead of for a short distance only. Other improvements have been introduced which, besides improving the appearance of the machine, add greatly to the convenience of operating it, and to its capacity. The machine has an automatic feed, which is automatically tripped at any desired point, and is also provided with a special rapid feed for reaming. The head is provided with an internal friction clutch for the back gear, which is worked by the lever back of the main gear, and enables the back gear to be thrown in or out without stopping the machine. A rack and pinion motion is provided for moving the foot-stock or turret-slide block on the bed, and adjusting it, this being worked by the crank shown at the side of the block. The turret is revolved automatically by the movement of the slide, the same as a screw machine. Spindles have holes entirely through them, and every effort has been made to make the machines as efficient as possible for the line of work for which they are adapted. The engraving typifies a full line of similar machines of various sizes and adaptations, this particular style being made in sizes from 21″ to 36″ swing. The machines are furnished with draw-back collet mechanism, when desired, or other modifications are made adapting them to special requirements.

The second cut is of a 21-inch turret head engine lathe, which is the same as the regular lathe built by the company, but has the friction clutch for throwing the back gears in or out, in addition to the usual lever by which they are moved out of engagement entirely when desired. The turret slide has automatic feed and stop motion. The spindle has a 2¼″ hole through it. Any desired modification of this machine is made to order, such as the addition of taper attachment, changes in style of tool rest, screw gearing, number and diameter of turret holes, length of bed, etc. With a 10-foot bed the length that can be milled is 14 inches, and the weight with countershaft is about 3,500 pounds.

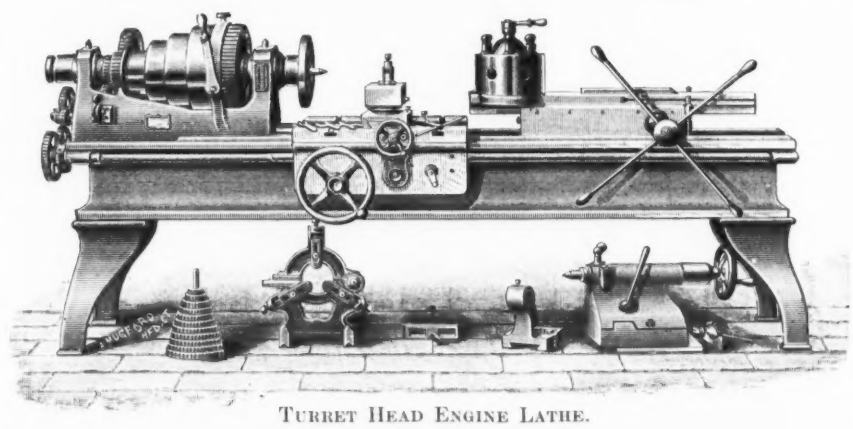
The third engraving is of a key-seating or spline milling machine. It consists essentially of a bed to which is fitted a carriage, moved along the bed by a screw, and carrying a spindle, which is driven from a splined shaft at the rear. This spindle carries the milling cutter at its outer end, the spindle having endwise adjustment for centering the cutter over a shaft. In front are two knees, which are moved up or down together, by means of the connected screws and hand wheel, and upon these knees is placed the table to which the shaft is fastened. Shafts of any size up to 6 inches diameter can be key-seated, and a shaft of any length can be fastened to the table and milled 4 feet at one setting. The table is 4 feet 9 inches long, 16 inches wide, and has a vertical movement from 6 inches (highest point) to 18 inches below the center of the spindle.

An auxiliary end milling attachment is also furnished, which has a vertical spindle,

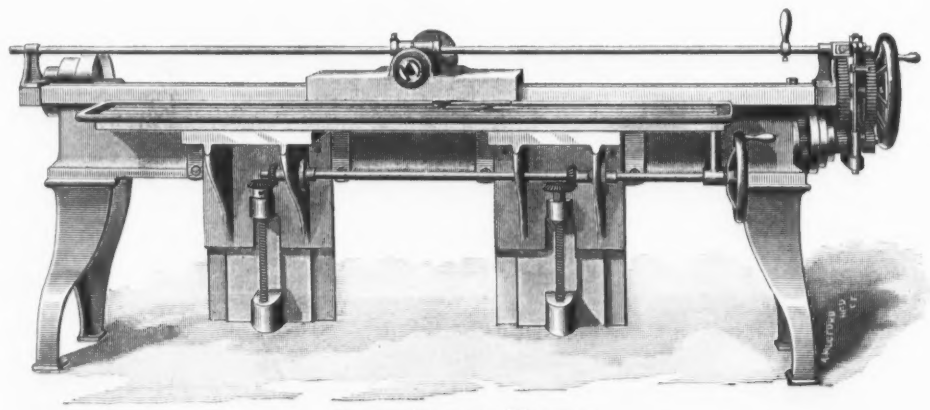


TURRET HEAD CHUCKING MACHINE.

and may be used for rounding the ends of key-ways. The machine can, of course, be used for other long jobs of milling, as well as for key-seating. The machine weighs, complete, 5,500 pounds.



TURRET HEAD ENGINE LATHE.



SPLINE MILLING MACHINE.

The recently published report of Mr. Bishop, Chief of the New Jersey Bureau of Labor Statistics and Industries, contains much that can hardly fail to be of interest, not only to those who are connected with railroads, but to the general public as well. According to this report, on that part of the Pennsylvania system which is within the State of New Jersey, 172 employes were killed or injured during the past year in coupling cars, while the total number of employes killed and injured in all kinds of accidents was 398. The number killed and injured who were not employes of the road was 207 in the same year. Other roads of the State lost about the same number in proportion to the number of men employed, the total number of accidents of all kinds to employes being 863; 101 of which were fatal Mr. Bishop calls attention to the fact that, while there are a number of laws on the statute books intended to secure the comfort and safety of passengers, the employes have nothing except a few laws intended to secure the payment of their wages; and this, notwithstanding the fact that the laws of the State in effect recognize railroad employes as public servants, and impose severe penalties for certain failures in duty, which are not attempted to be regulated by law in other States. Massachusetts and New York are declared to be far ahead of New Jersey in this respect, while England is far ahead of any of the States. Referring to the question of railroad beneficial aid societies, that of the Baltimore & Ohio is the only one in which membership is compulsory, and it appears from this report that, in addition to this compulsory feature, members are required, before receiving benefits, to forfeit all rights to any claim for damages against the company in case of accident.

Leather Ropes.

BY W. H. BOOTH.

During a recent tour in Yorkshire through the woolen district, I had an opportunity of seeing a fairly large installation of square ropes of leather, which were giving great satisfaction.

These ropes were built of leather strips 1¼ inches wide up to a square cross-section, every strip breaking joint. They had been running several years, and had about ceased to stretch, having been shortened four or five times by seven or eight inches at a time, a total length of one yard being in all removed.

I made special inquiry into the method of splicing, and found it to be by common wood screws, simply screwed into the material. The large driving drum was 21½ feet in diameter, and the rate of revolution was 46 per minute, the speed of the ropes being only 3,100 feet per minute. Formerly the speed of revolution was 60, but it had been reduced for some reason, and, though the weight turned was now much less than formerly, the ropes at the slower speed showed more signs of distress than before the reduction

There were 16 ropes in all, and some of the ropes lay twisted in the grooves, and there seemed little or no difference whether a rope lay as intended, or became twisted and riding on its corners.

The grooves in which the ropes lay did not seem to be turned square to fit the ropes, which, when not revolving round their own axis, lay with one flat side against one or other of the inclined sides of the turned grooves.

Considering the great strength of leather, such ropes seem to offer one of the best means of transmitting power between fast running pulleys.

It seems probable, also, that a square rope will absorb much less power than a round compressible rope of fibrous material, which are usually made to run between the sloping sides of **V** grooves, and must waste much power in internal friction and differential velocity friction. In breadth of pulley face occupied, the square rope has the advantage over double belting to the extent of fully 50%, even in ropes only 1¼″ square, the advantage increasing as the side of the square increases. Leather belts, too which can be pieced by so simple a means as wood screws, are easier to splice and shorten than are ropes in which the neatest splice is either thicker or weaker than the body of the rope.

I saw also a very neat method of belt splicing, quite good enough for ordinary work. It consisted in slightly thinning off the ends to be joined, and rounding them to a semi-circle, as in the sketch (page 2). The operator carried with him a flat plate of iron, about 15 inches × ½″ × 3″; on this he laid the belt ends overlapping, and simply nailed them together with tacks about ⅝″ in length, the points **of**

the tacks turning on the anvil plate and re-entering the belt as in Fig. 2. The plan was both expeditious and quite satisfactory, and especially good when a new belt required several takings up. Any degree of smoothness may be secured by trimming down the overlaps, but ordinarily the amount of overlaps was only perhaps five inches, and little shaving down was, as a rule, practiced, and the tacks only extended round the semi-circular ends, as in Fig. 1. Perhaps the plan is new to some readers of the American Machinist, as it is to me.

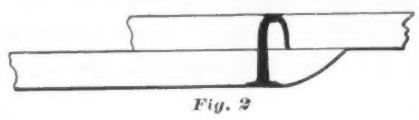


Fig. 2

Fig. 1

Leather Ropes.—See Page 1.

Practical Drawing.

By J. G. A. Meyer.

EIGHTY-EIGHTH PAPER.

633. In order to point out plainly the principles upon which the construction given in Figs. 511, 511*a* (last paper) is based, we have shown in Figs. 513, 513*a* the pyramid alone, the prism being removed; and for the sake of easy reference, we have simply indicated by dotted lines the position formerly occupied by the prism. The lines of intersections of the prism with the pyramid are of course represented by the boundary lines of the opening through the pyramid.

We may say at once that these lines of intersection have been found by passing auxiliary cutting planes through the pyramid. Thus, for instance: Assume that through the line $e_2\ f_2$ (Fig. 513) we pass an auxiliary cutting plane perpendicular to the horizontal plane of projection; this cutting plane will intersect the lateral face $v_2\ a_2\ b_2$ of the pyramid in the line $m_4\ p_2$; it will also intersect the lateral face $v_2\ b_2\ c_2$ in the line $p_2\ m_{10}$. The vertical projection of the line $m_4\ p_2$ is found by drawing a vertical line through the point m_4 cutting the base $a\ c$ (Fig. 513*a*) in the point m_3, and drawing through m_3 a line $m_3\ p$ parallel to $a\ v$; the line $m_3\ p$ is the vertical, and the line $m_4\ p_2$, as we have already seen, is the horizontal projection of the line in which the cutting plane intersects the lateral face ($v\ a\ b$, $v_2\ a_2\ b_2$) of the pyramid. In a similar way the line $m_5\ p$ (Fig. 513*a*) is found; the line $m_5\ p$ will be the vertical, and the line $m_{10}\ p_2$ the horizontal projection of the line in which our cutting plane intersects the lateral face ($v\ b\ c$, $v_2\ b_2\ c_2$) of the pyramid. Now, referring back to Art. 606, and Figs. 496, 496*a*, we find that we have followed the construction there given, and that the triangle $p\ m_3\ m_5$ (Fig. 513*a*) is the outline of a section made by the cutting plane passed through the pyramid. But the lateral face $e\ f\ g\ h$ of the prism is a part of the cutting plane, consequently the lines $l\ m$ and $n\ o$, which are portions of the lines in which the cutting plane intersects the lateral faces of the pyramid, must be the lines in which the face $e\ f\ g\ h$ of the prism cuts the same lateral faces of the pyramid. Hence our construction in Figs. 511 and 511*a* is correct.

634. We can obtain the same results in a different way, namely: instead of passing through the pyramid cutting planes perpendicular to the horizontal plane of projection, we may pass through the pyramid cutting planes perpendicular to the vertical plane of projection. Thus: Assume that through the line $e\ f$ (Fig. 513*a*) we pass through the pyramid a cutting plane perpendicular to the vertical plane of projection; the section made by this cutting plane will be similar to the base of the pyramid (see Art. 595), consequently this section will be a square; to find the horizontal projection of this square section we follow the instructions given in Art. 593, and we will find, that $l_4\ e_4\ l_2\ n_2\ f_4\ n_4$ will be a portion of this square. Again, in passing through the pyramid a cutting plane through $g\ h$ perpendicular to the vertical plane of projection, we again obtain a square section, of which $m_8\ a_4\ m_6\ o_2\ c_4\ o_4$ will be a portion. Now, drawing through the point l_2 (Fig. 513) a vertical line, cutting $e\ f$ (Fig. 513*a*) in a point l, and also drawing a vertical line through m_6 cutting $g\ h$ in the point m, and then joining the points l and m, we again obtain the line of intersection $l\ m$ as before. In a similar manner we may find $n\ o$.

To test the accuracy of the last construction, prolong the lines $m\ l$ and $o\ n$ upwards; if now the construction has been accurately drawn, these prolonged lines will meet in a point p, on the line $v\ b$, and the horizontal line $p\ q$ drawn through p will be equal to $v_2\ p_2$ in Fig. 513.

635. Now in regard to the development of the convex surface of the pyramid, shown in Fig. 512, we only need to point out the fact that, since in Fig. 513 the line $l\ m$ is parallel to $v\ a$, and since both lines lie in the same face or plane $v\ a\ b$, the projections of these lines will always be parallel, no matter in which position the face $v\ a\ b$ may be placed; again, since the lines $e_3\ l$ and $g_3\ m$ are parallel to $a\ b$, and since these lines lie in the same face $v\ a\ b$, they will always be parallel in any other view or projection. Now this face is represented in Fig. 512 by the triangle $v_0\ a_0\ b_0$, consequently $l_9\ m_9$ must be parallel to $v_0\ a_0$, and the lines $e_9\ l_9$ and $g_9\ m_9$ must be parallel to $a_0\ b_0$. Similar reasoning applies to the other boundary lines of the openings in the development.

It is of the utmost importance that the student should be thoroughly familiar with the methods of finding the lines of intersections by means of auxiliary cutting planes, as these methods will be frequently employed hereafter.

Problem 104.

636. *Intersections of pyramid with prism.*

Let Figs. 514*a* and 514 be the vertical and horizontal projections of a pyramid and prism, the latter being passed through the former; it is required to find the intersections of the surfaces.

In this problem we have a pyramid and prism of the same size as those given in the last problem, the only difference between the two problems being that the prisms occupy different positions relative to the pyramids.

A draftsman can readily see, without finding the lines of intersections, that, under the conditions given in the elevations, the prism will cut the pyramid in two pieces. But for the sake of practice we shall assume that this fact is not known until the lines of intersections have been found.

Through the point m_6 (Fig. 514) in which the line $e_2\ h_2$ cuts the line $a_2\ b_2$, draw a vertical line cutting the base $a\ c$ (Fig. 514*a*) in the point m_3; through m_3 draw a line $m_3\ p$ parallel to $v\ a$, and terminating in the point p in the line $v\ b$. In a similar manner find the line $m_5\ p$, which, if correctly drawn, will also terminate in the point p. Now since the point p lies below the line $e\ f$, it follows that the pyramid is cut in two pieces. The line $m\ p$ is the line in which the face $e\ f\ g\ h$ of prism intersects the face $v\ a\ b$ of the pyramid; and the line $o\ p$ is the intersection of the faces $e\ f\ g\ h$ and $v\ b\ c$. The lines $g_3\ m$ and $o\ h_3$ are the lines in which the lower face $g\ h$ of the prism cuts the lateral faces $v\ a\ b$ and $v\ b\ c$ of the pyramid. Comparing this construction with that in

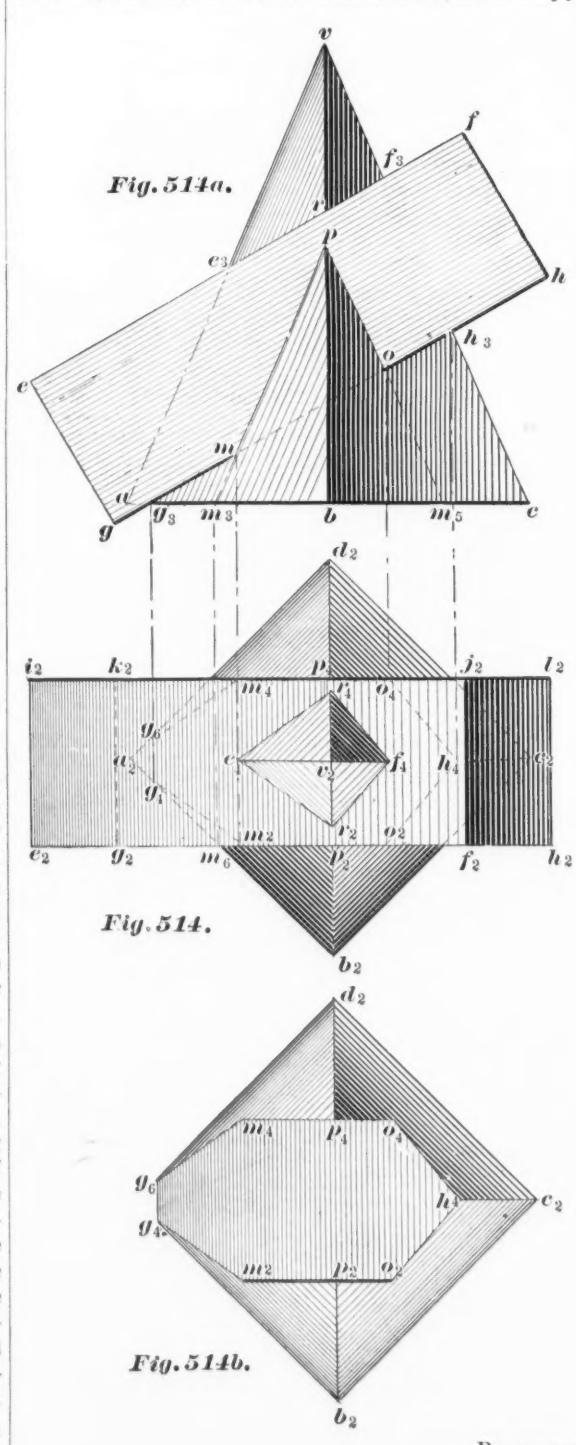


Fig. 514a.

Fig. 514.

Fig. 514b.

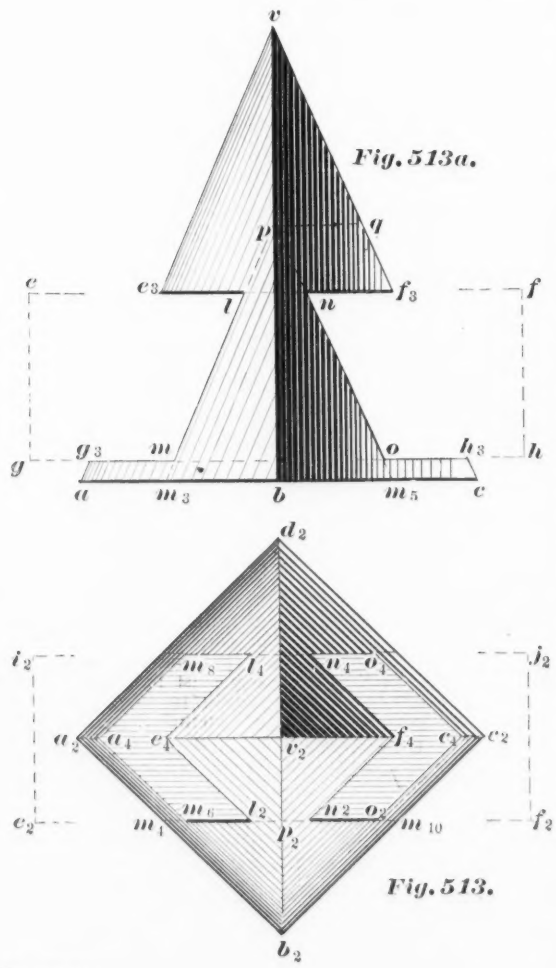


Fig. 513a.

Fig. 513.

Practical Drawing.

portion of the pyramid which is represented in Fig. 514*a* by $v\ e_2\ f_2$; the polygon $e_4\ r_2\ f_4\ r_4$ is found in the same manner as we would find a section of the pyramid, made by passing through the pyramid a plane $e\ f$ perpendicular to the vertical plane of projection, and this has been explained in Art. 587, and illustrated in Figs. 488 and 488*a*.

To find the horizontal projections of the intersections of the lower face $g\ h$ of the prism with the lateral faces of the pyramid, we proceed as follows:

Through the point g_3 (Fig. 514*a*) draw a vertical line, cutting $a_2\ b_2$ (Fig. 514) in the point g_4, also cutting $a_2\ d_2$ in the point g_6; the triangle $a_2\ g_4\ g_6$ is that portion of the base which is cut off by the lower face of the prism. Again, through the point m (Fig. 514*a*) draw a vertical line, cutting $g_2\ h_2$ (Fig. 514) in the point m_2, and also cutting $k_2\ l_2$ in the point m_4. Join the points g_4 and m_2, also g_6 and m_4 by straight lines; the line $g_4\ m_2$ is the horizontal projection of the intersection, which, in Fig. 514*a*, is represented by the line $g_3\ m$, and the line $g_6\ m_4$ is the horizontal projection of the line in which the lower face of the prism intersects the lateral face $v_2\ a_2\ d_2$ of the pyramid; the vertical projection of this line coincides with and is hidden by the line $g_3\ m$. Through the point o draw a vertical line, cutting $k_2\ l_2$ in the point o_4, also cutting $g_2\ h_2$ in the point o_2. Again, through the point h_3 draw a vertical line, cutting $v_2\ c_2$ in the point h_4; join the points o_2, h_4, also o_4, h_4, by straight lines. The lines $o_2\ h_4$ and $h_4\ o_4$ are the horizontal projections of the lines in which the lower face of the prism intersects the lateral faces $v_2\ b_2\ c_2$ and $v_2\ c_2\ d_2$ of the pyramid.

637. The horizontal projections of the intersections can also be found as shown in Figs. 498 and 498*a* (eighty-third paper), namely, find the section made by passing through the pyramid a plane $g\ h$ perpendicular to the vertical plane of projection; then $g_4\ m_2\ o_2\ h_4\ o_4\ m_4\ g_6$ will be a portion of this section.

Fig. 514*b* simply shows a plan or horizontal projection of the lower part of the pyramid, the prism and the upper portion of the pyramid being removed.

Directions.—In the space marked Prob. 104, draw the vertical and horizontal projections of a pyramid and prism, as shown in Figs. 514, 514*a*. Altitude of right pyramid, 10 inches; base, 6 inches square; length of prism, 10½ inches, 3½ inches square; distance from the point a to the point g_3 (Fig. 514*a*), 1 inch. The line $g\ h$ is to make an angle of 30 degrees with the base $a\ c$. Find the intersections. Use 3-inch scale. It is not necessary to show Fig 514*b* directly under the other views.

Problem 105.

638. *Intersection of pyramid with cylinder.*

Let Figs. 515*a* and 515 be the vertical and horizontal projection of the pyramid and cylinder, the latter being passed through the former; it is required to find the intersection of the surfaces.

These intersections will be curves. To find these intersections we need an end view of the cylinder, as shown in Fig. 515*b*; the center of this circle may be placed at any

convenient distance from $e\,g$, but its center must lie on the line 4 d, i prolonged.

Divide one-half of the diameter $j\,h$ into any number of equal parts, say four, and through the points of division draw the vertical chords 1 j, 7 j, 2 j 6 j and 3 j 5 j. Through the points 1 j, 2 j, 3 j, 5 j, 6 j and 7 j draw horizontal lines, terminating in the points 1 d, 2 d, 3 d, etc. Also divide $d_3\,h_3$ (Fig. 515) into four equal parts, and through the points of division draw horizontal lines, cutting $a_3\,b_3$ in the points 1 b, 2 b, 3 b, and through these points, also through 4 b, draw vertical lines cutting the base $a\,c$ (Fig. 515a) in the points 1 a, 2 a, 3 a and 4 a; through these points draw lines parallel to $a\,v$. Now it must be evident that the point d_3, in which the line $d\,e$ cuts $v\,a$, must be one point in the curve of intersection; the point 1, in which the horizontal line through 1 d cuts 1 a 1 p, is another point in the curve; the point 2, in which the horizontal through 2 d cuts the line 2 a 2 p, is the third point in the curve. In a similar way we obtain the points 4, 5, 6, etc.; or, commencing from the bottom, we have the point in which the line $f\,g$ cuts the $v\,a$ as one point in the curve, and the point 7, in which the horizontal through 7 d cuts the line 1 a 1 p, will be another point in the curve; the point 6, in which the horizontal through 6 d cuts the line 2 a 2 p, will be the next point in the curve, and so on. Now, the curve joining all the points d_3, 1, 2, 3, 4, 5, 6, etc., will be the vertical projection of the curve in which the cylindrical surface cuts the face $v\,a\,b$ of the pyramid. In a similar manner we may find the curve extending from e_3 to g_3, in which the cylindrical surface cuts the face $v\,b\,c$. In the case before us, these curves will be equal to each other, and symmetrically arranged about the line $v\,b$.

To find the horizontal projection of this curve (Fig. 515), we draw through the point d_4 (Fig. 515a) a vertical line, cutting $d_2\,e_2$ in the point d_4. Through the point 1 (Fig. 515a) draw a vertical, cutting the horizontal through 1 f (Fig. 515) in the point 2; in a similar manner we obtain the points 3, 4, 5, etc., in Fig. 515. A curve joining these points will be the required curve of intersection.

This will be made plainer in our next paper.

Scrap-Book Reflections.

By W. S. Rogers.

There is another item in shop management besides over-time, that always gives me the "horrors" when I come close to it, and that is the time check system. I have never tried it, but I have watched others try it, and I have concluded that it is very much like many other things—very good if properly used—but as only one man in a thousand knows how to handle it, it should not be dealt in too promiscuously. I have noticed most that it is the man with dollars, and no knowledge of humanity, that cries loudest for it, and he can always find some one with selfish desires for personal advancement in the favor of Mr. Greed, ready to grind on the time check system in the most rigorous manner.

For instance, Tim was late one morning, only one minute; the clerk was locking the box, but refused his check, and the foreman informed him that he was docked fifteen minues that day. Tim was a good mechanic with a good record, but before the six o'clock bell rang he was two dollars ahead of the firm, and had become a dishonest man, just because the firm had set him a good example in rascality in the morning. I have met several examples like this.

On the other hand, I was in a shop recently where it is used as a check to guard against the evil of coming in late, and I noticed that the men did not watch the boss, as he moved around, out of the corner of their eyes, but there was such openness and honesty of feeling between them that the shop was brighter for it, the workmanship better, and the firm's profits satisfactory.

Something more important than time checks and long, tiresome, iron-clad rules, is the superintendent or foreman who understands

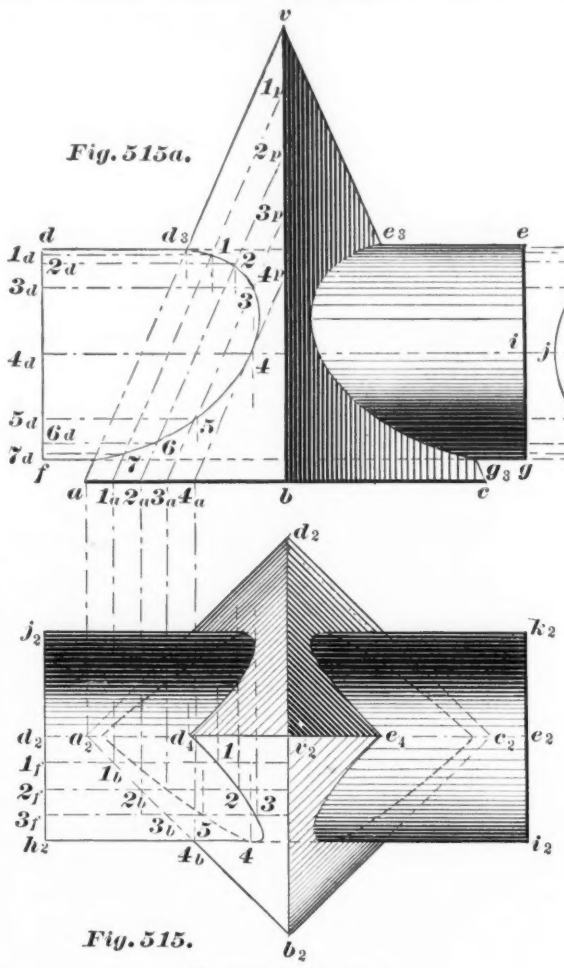


Fig. 515.

Practical Drawing.

human nature, and knows just how to handle the varying eccentricities of the men under him every day.

He may have the nicest eye in the world for a perfect fit, and illustrate theoretical mechanics in a manner almost practically correct, but if he is unable to successfully control the minds and thoughts of the hands at all times, his work is a failure, no matter how well he may be educated as a mechanic.

I have often thought it would be a good idea for our training schools and technical colleges to educate their students how to control and manage humanity as well as how to design and construct machinery. In our large shops to-day there are plenty able to make nice designs and plans, plenty more able to do the work of building from the design and plan if properly guided, but the one capable of leadership and executive ability, with justice to employe and honor to employer, and also able to declare dividends, is a scarce article, and commands a premium in market. I know of several firms searching for such men, but, as they have earned a reputation for making cheap goods, they don't want to pay the par value even. In proof of this here are extracts from a letter from a firm whom I will call Blank & Co., because it is not their name:

Dear Sir: We want a practical mechanic, one who has learned his trade and can work himself. The salary would depend upon the qualifications of the man, also the permanency of his position. We want a man who can consult with our Mr. Blank, and take hold of the best machine of each class mentioned, and produce as good a one, or better. This party must have inventive ability and mechanical ingenuity sufficient to get around the patents covering the machines now in use, make a machine as handy, durable and tasty in design and appearance as any, and capable of doing as much work, at least, as the best machine of each class upon the market, put the machine upon paper, and overlook the work all through, from the drawings and patterns to the finished machine, take the machines into the country and test them fully, to insure their perfect operation. We have no money to spend in furnishing a man experience, nor do we want a man to waste our money in errors and mistakes, throwing away patterns, etc., but some one who can put the work right straight through without experimenting and throwing away patterns. If you consider yourself able to do this class of work, will you be kind enough to inform us of the several places where you have worked, what positions you have held in each, the names of the machines upon which you have worked, and the names of the parties for whom you have worked. We must have excellent recommendations, must know our man has the ability, and that he is trustworthy, sober and a "hustler;" a slow man we do not want. We do not require a high-priced man.

Yours, very truly,
Blank & Co.

The meat of the entire letter is contained in the last sentence, and I've no doubt that they found the man at a low price, but if he also managed to work a half a dozen or so of his relations in on the pay-roll to help him out, I could not blame him.

Now here is an extract from a letter just received from one of the "toilers":

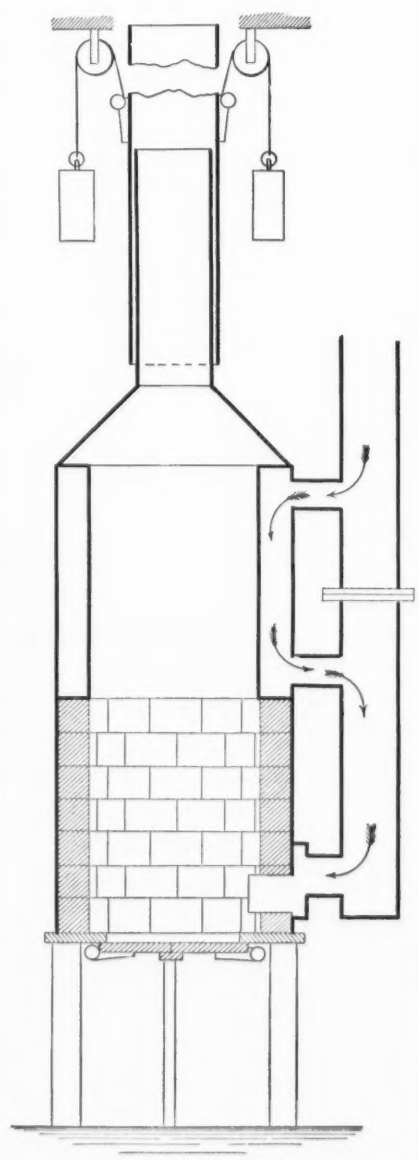
Dear Sir: . . . I have some examples to work out to-night yet, in mechanics. My friend, Mr. Hill, is teaching me. I will give you the easiest one, and you will see in an instant what I am trying to learn. I would like a place where I could use my brains a little more than I do. I have it in me if I could have the chance to develop. If you should happen to get me a place with you, which I hope you can, you can bet I would study up, as it would give me the opportunities.

I work till ten o'clock, and get home by half after, then study till midnight; and it is doing me up. I now have Rose's complete works on machine shop practice, and it only cost me seven dollars for thirty numbers.

The only time Mr. Hill can get to teach me is at work, and sometimes we get caught and are drawn over the coals for it. We must stop it, though, or one of us is liable to lose our job.

Yours respectfully, Jim.

Possibly Jim will feel discouraged when he reads Messrs. Blank & Co.'s letter, especially when he finds that the market for brains is being "bulled" pretty strong, but my advice is to stick to the midnight oil, and bear in mind that the "low-priced" firms are nearing the end of their day.



A Small Cupola.

A Small Cupola.

By Thos. Wathey.

Some time ago I visited a small foundry in Saratoga, and there saw something that struck me as being new in connection with a cupola. It was not so much the cupola that drew my attention, as it was the idea of heating the blast before it mingled with the fuel and metal in the cupola. In giving a description of it I may not give the exact dimensions, but I suppose they will be near enough for practical purposes. The cupola has a drop bottom. Its outside shell is made in two sections, the bottom section being about 2 feet in diameter, and about 2 feet 6 inches high, and is bricked up to the top in the regular way (see illustration). The upper section is the same size as the lower one, but instead of having brick inside, it has an iron jacket, forming an annular space between it and the outer shell. The blast pipe is placed in the rear of the cupola. The blast enters the annular space at the top, and escapes at the bottom, into the lower branch of the blast pipe, and from there enters the tuyere box continuing about three-quarters around the shell, and projecting about one inch beyond the shell.

The stack is made of sheet-iron with a bonnet fitting the top of cupola; the stack is of the telescope type with weights attached to its upper portion, so that it can be raised or lowered at will. The height of cupola proper from the lower plate is about five feet, and it is about 16 inches inside diameter. From ten to twelve hundred pounds of metal can be melted at one cast. It is suitable for iron and brass.

The effort to locate the World's Fair in New York lags most decidedly; large bodies proverbially move slowly, and the various committees on the fair make up a large body. A sad mistake was made in the beginning by the Site Committee in putting in a claim for a part of Central Park. No greater boon could be given the Fair enterprise, than for this committee to declare unequivocally that not a foot of the park will be taken. The Site Committee misiakes the popular sentiment in regard to the use of the park.

If there is one thing more than another in which workingmen are interested, it is in preserving Sunday as a day of rest. There may be an honest difference of opinion as to how Sunday should be observed, but there should be no difference as to the question of preserving it as a day of rest. In some parts of Europe men work about the same Sunday as any other day, but that is not likely ever to be the rule here.

Notwithstanding the great cost of Eiffel Tower—one million dollars—it is believed that the money received for ascending it will, during the continuance of the Exposition, pay the cost of construction. It costs one dollar to go to the top of the tower, and a visitor to the Exposition hardly thinks he has done the proper thing unless he makes the ascent.

There is a movement to transfer the revenue marine service to the jurisdiction of the navy department. It appears to be a sensible thing to do. There is a surplus of naval graduates, and this will furnish some of them with work.

A correspondent would like some reader to give him a simple method for recovering the metal from the dross of babbitt metal.

The Waterbury Emery Grinder.

This machine may be used for the purposes for which the ordinary grinders are made, and also for flat surface grinding and finishing, and is well adapted for grinding hard or soft metal surfaces, the surfaces of punches and dies for sharpening them, flattening dies, or any work that requires a flat surface which will come within the range of the machine.

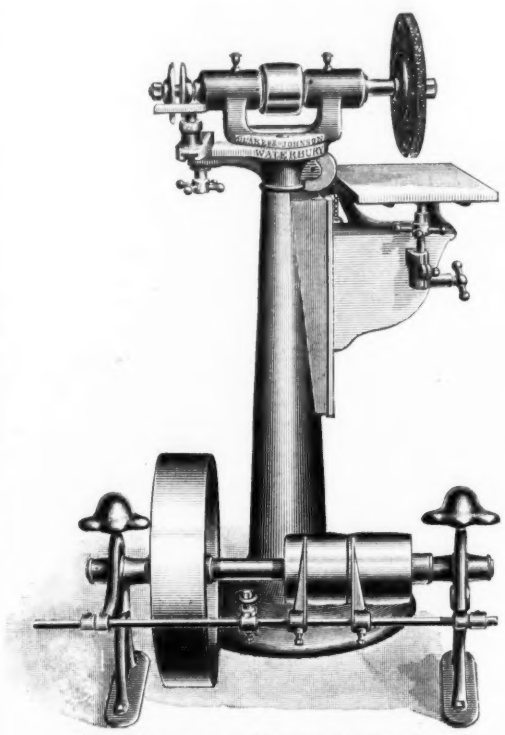
The table is 18 inches long by 9¼ inches wide and is placed on a knee that has a vertical adjustment of 8 inches; there is also a fine adjustment to the table with a range of 1½ inches. The table is hinged to the knee at one end, and there is an adjusting screw under the table at the opposite end, by which it may be raised and lowered to any desired point. The screw, being located underneath the table, is away from the dust coming from the wheel. The work is fed on the table under the wheel by hand.

The spindle is made of steel and runs in split conical boxes, on the best anti-friction metal.

The size of emery wheels best adapted for the machine is 10 inches in diameter, ¾ inch face.

The height of the spindle from the floor is 40 inches; distance between emery wheels 15¼ inches, bearings 1¼″ x4½″.

The makers are Blake & Johnson, Waterbury, Conn.



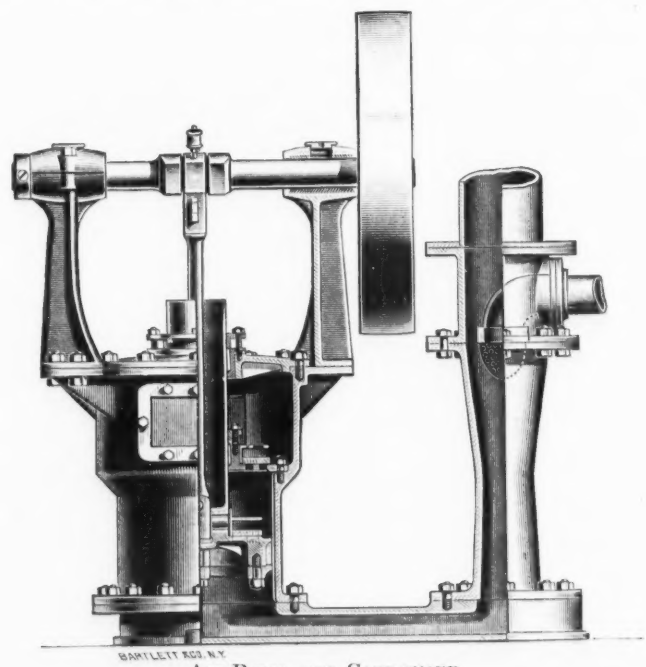
The Waterbury Emery Grinder.

Improved Belt-Power Air-Pump and Condenser.

The air-pump and condenser illustrated on this page has been newly designed by the builders, Conover & Co., 219 Market street, Newark, N. J., in answer to the demands of power users who are seeking the greatest attainable economy in all details of the modern steam plant.

With the introduction of high-speed compound engines, there is felt the need of a thoroughly efficient and simple condensing apparatus. The power required to drive it must be reduced to a minimum, and this power should be of the most economical sort, otherwise the advantages gained by condensing will be seriously affected, or, perhaps, wholly counteracted. In fact, it is a matter of record that tests have shown that engines, in some cases, have shown better economy running non-condensing than when condensing, owing chiefly to the very wasteful manner in which the power was applied to the condensing apparatus.

The builders of the apparatus illustrated believe that they have attained a highly efficient, simple and durable arrangement. As will be seen by the engraving, the air-pump is run by belt, which can be direct from the engine shaft or from a countershaft, whichever may be the more convenient. Being driven by the main engine, it is obvious that the power used to operate the air-pump must of necessity be of the same economy as the engine. Thus, if the engine in question be compound condensing, running on two pounds of coal per horse-power, or less, it necessarily follows that the air-pump will be operated with similar economy. An examination of the engraving will make the operation of the condenser and air-pump plain. The spray distributes the injection water in such a manner that every particle of steam must come in contact with it, and thus effect condensation with a minimum amount of water, and at the same time heat the overflow to the maximum temperature. The opening from condenser to the air-pump is of the shape which allows the greatest quantity of water to flow through an opening of given area. The pump is made amply large to remove the greatest quantity of water needed for condensing to the full capacity of condenser. The reciprocating parts are counterbalanced by means of a weight in the wheel, to insure smooth running. As will be seen, the air-pump is vertical and single-acting, the experience of the builders having convinced them that this is the best form to avoid air-locks. The design throughout looks to the avoidance of all corners or pockets where air can collect and remain. This condenser is specially suited to the requirements of high-speed compound engines in electric light and power plants, because it can be run at a speed independent to that of the engine, or may be attached to more than one engine. It is also adapted to be applied to existing plants as a saving of fuel, or an increase of power on same fuel.



Air-Pump and Condenser.

The materials and workmanship are such as to insure satisfactory working. When air-pump is in operation the valves and stuffing-box are constantly covered with water, effectually sealing them. All parts are easily accessible without dismounting wheel or shaft.

The machines are made in sizes ranging from those adapted to 60 horse-power up to 600 horse-power plants.

Shop Notes.

Most of the machine shops in Philadelphia are very busy at present, and indeed many of the most prominent ones are crowded with work, finding it difficult to get men enough, and find room for them to work in, to keep up with orders. Pedrick & Ayer have moved into their new shop, which we announced the building of some time ago, and had abandoned the old one with the intention of leasing it to other parties. But owing to the increase of business it was found necessary to re-open it, and it is now used for jobbing work and repairs, the new shop being used exclusively for new work in their regular lines of special tools and milling machines. When they came to try to secure the ground on which to build their new shop, they came into contact with one of the numerous two-legged porcine specimens that owned a small triangular piece of ground covered by dilapidated buildings which it was desirable for them to have. The owner wanted to sell it, but gauged his price in accordance with what he supposed was P. & A.'s peculiar need for it. After offering more than it was really worth, and finding that it could not be had at less than about four times its value, they concluded to try to build a satisfactory shop without it. This makes the shop somewhat peculiar, but still it is evident that it is well adapted to their purposes. It reaches through from one street to another, and light is obtained from the front and back and down through a skylight; two large openings being left in the upper floor, to admit light from above to the lower floor. The light obtained in this way is excellent on both floors, the front and rear windows being unobstructed in the lower story, but occupied by the offices and pattern shop in the upper one, which is amply lighted by the skylight alone. Through the center of the shop is a row of iron posts, and for the lower floor, where of course the heavier work is done, a very simple swinging crane is fitted to each post, so that nearly the entire floor is served by them. Teams can drive in at the rear door and alongside a platform, which is above the floor at about the height of a wagon, and on this is the stock of bar iron and steel, and the tool dresser's forge. Under this platform and in the basement are the engine and boiler rooms, the latter next the street, and the coal bins under the sidewalk. In the basement also is what the members of the firm facetiously refer to as their back yard, and in which the stock of castings is kept. The elevator runs down into it, and is accessible to the trucks, which deliver castings. Every inch of space is utilized, and every one is happy except, perhaps, the man who retains his precious ground.

Just under the roof a third floor is laid, and the walls are so proportioned, that it will be an easy matter at any time, when it becomes necessary, to raise the roof, extend the walls another story, and thus have another floor for work.

A. Falkenau, who has a shop near Pedrick & Ayer's place, and builds special work to order, is also putting an appliance onto plain slide-valve engines, by which they are changed to automatic engines. The steam chest is raised high enough to admit two valves instead of one, the lower one being worked by an eccentric in the usual way, while the upper one, which is the cut-off valve, is controlled by the governor. A machine for making barrels is about to be commenced here, which will be somewhat remarkable. It will take the staves which compose a barrel, which have been previously trimmed on the sides, and will cut them to length, cut the notch into which the head fits, put the staves together, and put temporary hoops on them, and will do this at the rate of one hundred barrels an hour. Perhaps the most remarkable thing about it, however, is the fact that it is the invention of a woman, some of the members of whose family have been interested in barrel making, and who thus became familiar with the business. There seems little if any doubt that the machine will work, and it must be admitted to be rather an ambitious undertaking for a woman.

A method adopted by Mr. Falkenau for testing the accuracy of a lathe, which he had in the shop, may prove to be not without interest to many, and is here given as follows. He first carefully faced off the large face-plate in position on the spindle, a straight-edge of course showing whether or not the cross-slide of the carriage was at right angles to the head-stock spindle. He then took a bar which had been turned true and of uniform size throughout, and placed it on the centers, fixing to one end of it an arm, which extended out as far as the face-plate, and carried a pointer, which could be brought close to it. By means of tissue paper placed between the pointer and the face-plate he secured the same contact between them at all points on the plate, revolving the shaft on the centers, and moving the foot-stock spindle over one way or the other, until the contact on the plate was uniform. When this condition was obtained it is of course evident that the bar was at exact right angles to the face-plate, and consequently exactly in line with the spindle. It is also evident that if the bar is now found to be in exact alignment with the shears, then the head-stock spindle and the shears must also be in alignment one with the other. This was tested by means of a suitable piece fastened in the tool-post and moved along from one end of the bar to the other, and, by means of pieces of tissue paper placed between the bar and the end of the piece, the alignment of the bar with the shears tested. Measurement of the thickness of paper required at one end in excess of that required at the other, in order to get the same contact, showed the amount of error in thousandths of an inch.

The contact of the pointer with the face-plate should of course be the same at the top and bottom, and if not, then it is known that one spindle is higher than the other. The shorter the bar used, the more apparent this error; but if one is used which is equal in length to the radius of the face-plate, then the different thickness of paper required at top and bottom will show directly the amount of error. The alignment of the foot-stock spindle can be tested in the same way. First a short bar is put on the centers, and with the foot-stock center projecting the shortest possible distance from the stock, it is adjusted until the pointer has the same contact at all points on the face-plate as before, thus proving it to be in line with the spindle. Now, leaving everything in position, the foot-stock is loosened from the bed and the center run out to a considerable distance; if it moves out in a straight line true with the head-stock spindle, it will, when tested again, be found to be in line as before; but if the spindle does not move in a line which is exactly true with the head-stock spindle, the pieces of tissue paper will show that the bar is no longer in line with the spindle, and has consequently been moved one way or the other by the amount that the foot-stock spindle is out of line. It will be perceived that, by the use of appliances which are always available in any machine shop, a very complete and critical test can be given a lathe.

At the works of Wm. Sellers & Co., the fact that they are enlarging and improving the arrangement of their shops, in accordance with the plan outlined in these notes some time ago, together with the fact that they are unusually busy on regular lines of work, gives everybody connected with the establishment about all he feels able to do. One part of the contemplated improvements is finished, *i. e.*, an erecting shop, which forms an L with

the machine shop, and near which will be placed the heaviest tools, in order that they may be served by the traveling crane provided for this department. This crane, which of course is of their own manufacture, was at the time of our visit about to be hoisted into place. It is of 30 tons capacity, 57 feet span, and weighs complete about 35 tons. It will be at a height of 32 feet from the floor, and will be driven by an electric motor. Their traveling cranes are provided with mechanism that is essentially the same as that used on the thirty-ton swinging crane, illustrated in our issue of Dec. 1, 1888. The new erecting shop has an unusually high roof, with an uncommonly large area of glass admitting a regular flood of light, and it is apparent that, when all the shops shall have been constructed on the same plan as is contemplated, they will be among the finest and best arranged engineering establishments in the country. Special attention will be given to the equipment of power cranes, mainly, of course, with a view to economy in handling work and materials, though it is not unlikely that a desire to have an example of what can be done in the way of crane equipment will have more or less to do with it.

The marvelous Baldwin Locomotive Works are at present turning out twenty-eight complete locomotives weekly, or at the rate of 4¾ per day, or a complete locomotive in every two hours and eight minutes of time. These are really astounding figures, and the mind fails to take in their full significance until one has gone through the works and noted the small army of men employed, and the vast equipment of machinery. It has been remarked that there is comparatively little to be seen in these shops, which a tool maker would be apt to consider as indicating remarkably high efficiency, and in this connection the opinion of an eminent engineer, not, however, connected with the works, may be interesting. He seemed to think that the high efficiency is due largely to their system, which enabled them to quickly detect any weak spot, and take measures to strengthen it. At the beginning of every week, each foreman receives a blank form filled out, which indicates what work must be done in his department that week, in order to complete certain engines according to contract. If, for any reason, he thinks that he will be unable to do the specified work within the week, he gives notice to that effect, in order that suitable arrangements may be at once made, either for increasing his output in some way, such as by putting on more hands, by ordering night work in that department, or by sending part of the work to other departments, where practicable. Towards the end of the week it is the business of each foreman to ascertain if he is likely to finish the required work, and if not, to give the reason. When any department is found to be often or habitually behind, it is strengthened in some way, usually by the addition of men or machinery, or both. This plan obviates a great deal of vexatious and expensive delay, and at the appointed time, when the erection of an engine should commence, all the parts which are to compose that engine are almost sure to be ready to go together. Any weak link in the chain is at once detected, and every man who is responsible for a part of the work knows that, if his department falls in the least behind, he will be expected to give a satisfactory reason for it within a few days, and before any very serious or irreparable delay takes place.

At Bement, Miles & Co.'s place they are crowded with work, and are preparing to make very extensive additions to their already large buildings. The north wall of the present machine shop will be replaced by a row of pillars, and the shop will be widened and lengthened to 145x85 feet. Sixty feet of this width, the entire length, will be covered by two traveling cranes, which are to be made by Wm. Sellers & Co., the other fifteen feet of width being occupied by three galleries, one above the other, in which the lighter work will be done. There will be another building, 185x85 feet, also provided with cranes, and having the same arrangement of galleries, and besides this the foundry will be enlarged, so that when the work is completed the entire square, in which their works are now located, will be covered by their buildings. The other establishment, in which the steam hammers and boiler makers' tools are built, is also to be enlarged, so that there will be a total capacity to employ fully a thousand men, should business require it. Amongst the jobs on the floor, we noticed two large horizontal boring machines for the Washington Navy Yard, where they are to be used for work on gun carriages. The main spindle on these machines will be carried on a saddle, fitted to the face of an upright housing, and the work will be fastened to a table having movements in any direction, including a circular motion in a horizontal plane. The Bethlehem Iron Works are having a planer built which is 72 inches by 40 feet, and weighs 65 tons. The bed is 70 feet in length. The Providence Steam Engine Co. are having one built somewhat shorter, but which is to plane 84 inches high and wide. With the other machines which are to be seen on this floor is one nearly completed, which is out of the usual line, and is to be used in the manufacture of asphalt blocks for paving. It consists essentially of a large horizontal wheel, powerfully driven by means of cogs in its periphery. The upper face of this wheel is turned off smooth, and passing through it are a number of square holes about eight inches across, and lined with steel plates. Into these are fitted plungers, which are faced with steel, and which extend below the wheel, where they are fitted with rollers which, coming in contact with cams, force the plungers up

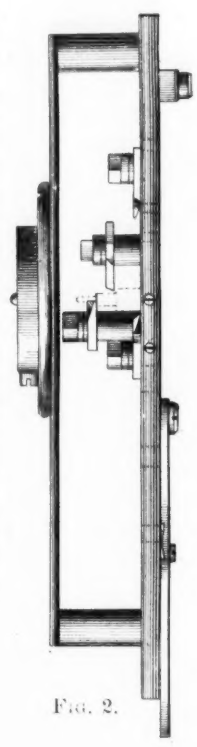
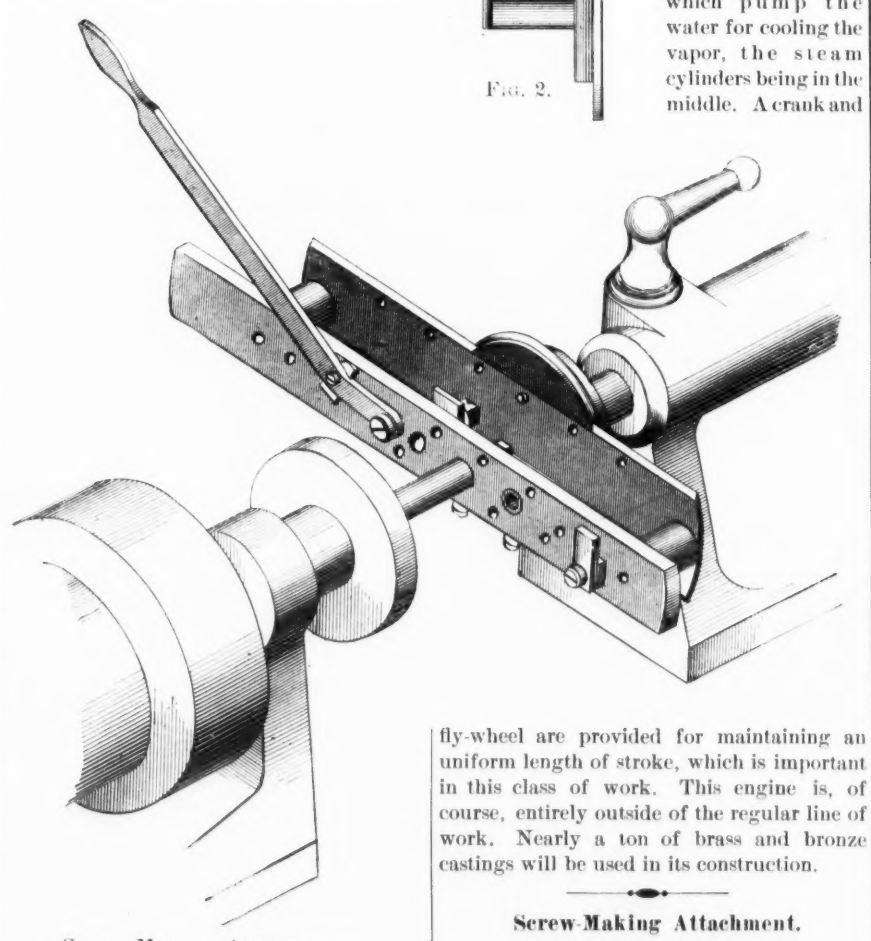


Fig. 2.



Screw-Making Attachment.

through the square openings. Above the wheel at one side is a hopper, heated by steam, into which the material is delivered, and from which it falls into each of the openings as they pass under it; the plunger, when at this point, being 3½ inches below the top face of the wheel. The slow revolution of the wheel carries the mould, now filled with the material, under a heavy conical roller, which presses it firmly into the mould, and from this it passes on around under a plate of steel, which is held down onto the face of the wheel by five springs, which together offer a resistance of fifty tons, and as the mould passes under this the roller below passes over a cam which forces the plunger upwards just one inch, compressing the material that amount. Passing on around and out from under this plate, a second cam below forces the plunger above the face of the wheel, carrying the compressed and moulded tile with it, at which time an automatic arrangement sweeps it off the wheel and onto a moving belt, which delivers them at a distance from the machine. These tiles are then to be laid for paving, instead of the present plan of laying the asphalt in a plastic condition, and letting it harden in position. The machine seems likely to bring about some changes in the matter of street paving.

The Barr Pumping Engine Works are also quite busy, and though their shops are scarcely two years old, the necessity for providing more room begins to be quite apparent. It will be secured probably by the erection of a new fire-proof building for the storage of patterns, and possibly by the addition of a new story to the main building. Amongst the jobs on hand at present is a pump which is being made for a sugar plantation in Cuba, and which possesses some features of interest. It will be duplex, with air-pumps at one end for pumping the vapor from the vacuum pans, while at the other end are those which pump the water for cooling the vapor, the steam cylinders being in the middle. A crank and fly-wheel are provided for maintaining an uniform length of stroke, which is important in this class of work. This engine is, of course, entirely outside of the regular line of work. Nearly a ton of brass and bronze castings will be used in its construction.

Screw-Making Attachment.

With this we give illustrations of a new device—an attachment to the lathe for making, rapidly, small screws and studs, such, as every machinist knows, consume much more time than their value seems to warrant when made by the usual method that must be followed in the absence of special fixtures. It was devised by a machinist, a large part of whose work consisted of repairs to sewing and knitting machines, model work, and such work as required a good many small screws, and has been found so satisfactory for this work that it was decided to enter into their regular manufacture. It consists essentially of a small face-plate, which is attached to the foot-stock spindle by a screw, and to the face of which is fitted a bar which slides across it in a dovetailed recess, and is stopped in six different positions by means of a pin, which may be placed in any one of the six holes shown in this bar. At the extremities of this bar, studs are fixed, upon which a second bar is supported, this bar being provided with holes which have steel bushings fitted to them, through which the wire or rod from which the screws are to be made passes; these bushings being brought to and secured fair with the center line by means of holes and pin in the other bar before referred to. On the back side of this second bar are fastened the tools which do the cutting, in the manner shown in Fig. 2. After the screw has been reduced to size and shape, which is done at one passage of the tools over it, the thread is cut by any common die, which may be placed against the front of the bar and run on. The small lever shown works a cutting-off tool with which the completed screw is separated from the rod. It will be seen that, with tools placed in position, screws can be made very rapidly by this fixture, and, by having bushings and tools set up for those most used, their cost can be reduced to a reasonable amount.

After the tools are adjusted by a mechanic, a boy can, of course, make the screws. It will make them from the smallest up to three-quarter inch diameter. Upon receipt of a sample screw which it is desired to make, the necessary tools for making it will be made and adjusted for the work, so that, when received, it is ready for work. The maker is John P. Berkholz, 101 N. 4th street, Philadelphia, Pa.

LETTERS FROM PRACTICAL MEN.

The Metric System.

Editor American Machinist:

In your editorial in the Machinist for October 3, on the "Decimal Association," you take the ground that the metric system is admissible, and were it not for the difficulty and trouble attending the change, the adoption of the decimal system in our measurements would be desirable.

It seems to me that you could not have heard, have not read, or have forgotten Coleman Sellers' paper presented at the first meeting of the American Society of Mechanical Engineers, or you would not take that ground.

I think if any man who gets the decimal system fever will get that paper, and take it in small doses, he will be effectually cured, before the remedy is exhausted. If there is any better remedy, it is to get a French rule divided in accordance with the metric system, go to work and try to do something in drawings or shop work. The decimal system is all right for money, which we have in use; all right for land measure, which we have in use; all right for figuring when you wish to work in figures, but a perfect nuisance when you want to make anything, unless it is a watch; and the millimeter the most inconvenient unit for mechanical purposes that could possibly have been invented.

The decimal division on a scale is a nuisance, because so easy to make mistakes, and it will not divide up.

The decimal system is never exact, unless you want to divide by two, five, or ten, whereas regular fractions are always exact; that is to say, it would be impossible to make, by the decimal system of measuring, three pieces of metal, one-third of an inch in length, and when the three pieces are put together, have the whole one inch long; also the same with six, seven and nine. With vulgar fractions there are no such conditions.

An inch is a natural unit; if you divide it into 100 parts they are too small for use in ordinary work, and too coarse if divided in tenths.

Besides, you cannot work to quarters or eighths, except to guess; neither could you if divided into hundredths; and this subdividing by two, four, and eight is exactly what one finds himself doing all the time.

The very best thing in the world to do with the metric system—or the decimal system—for lineal measurement in workshop practice is to let it alone.

The foregoing is composed of statements, and not facts or argument; but if one will take the trouble to read Coleman Sellers' ad-

mirable paper before referred to, he will find fact, argument, and fun enough to pay for the reading. C. U. Reed.

Cupboard for Milling Cutters.

Editor American Machinist:

The article in your issue of September 26th, page 6, on "A Cupboard for Milling Cutters," leads me to describe our arrangement, which has the advantage of not requiring a special cupboard, but may be fitted in any one of reasonable depth.

Our way may be thus described: Between two shelves, situated 14 inches one above the other, are fitted sliding boards, which are free to be pulled out entirely, or to such distance as will expose the desired portion of their side surface. These sliding boards stand in a vertical position, their length being the distance between the shelves, and their width equal to the depth of the cupboard. They are so spaced as to have a clear space of $1\frac{5}{8}$" between them. In one side of these slides we have turned wooden pins, which nearly fill the holes in the cutters, and on which they are hung. We use simple wire nails for the small screw center cutters In a space of 14" high, 18" long, 12" deep, we have seven boards, and have 109 pins, furnishing hanging accommodation for cutters from 5" diameter down. They will allow of hanging a cutter $1\frac{1}{4}$" thick. Cutters of one class we keep together as much as possible. These slides admit of changing their position easily—like a card index—and may be marked on the edge to indicate the class of cutters they bear.

Another plan, having some advantages, I think, over the one we use, would be to make the boards swing by pivoting them near the lower front corner on a rod, and forming them in quadrant shape; they could then be tipped out, until what was the lower edge would be vertical, when a pin through the board would catch and hold it. This is a considerable sacrifice of room over the other plan, but, I think, would handle easier. The cutters, of course, will turn on the pins during the swinging movement.

Bennington, Vt. Chas. S. Beach.

[Mr. Beach enclosed a sketch showing this arrangement, but did not refer to it in his description, and we suppose did not consider it necessary to publish it. But as it will probably help to make the matter plain, we have had an engraving prepared from it. The full lines show the position of the board when closed up, and the dotted lines the position when open. We are inclined to think that this has some points of superiority over Mr. Brady's cupboard, and that either of them are far superior to those usually seen in the shops. This matter of a suitable place to keep such cutters in is one which it would pay to devote more attention to than it usually receives; and, of course, this applies equally well to other things besides milling cutters.]

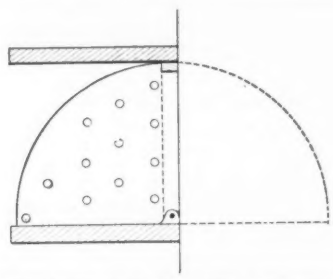
The Traveling Crane in the Foundry.

Editor American Machinist:

My experience is that for a foundry say one hundred and fifty feet long by forty feet or under wide, a one-trolley traveler is preferable. This will attend to the wants of from fifteen to twenty moulders, according to the class of work (all green sand). But if there are three or four loam moulders, it would be necessary to have two cranes of one trolley each.

For a foundry one hundred and fifty feet or more in length and fifty feet or more in width, two cranes of two trolleys each will do the work of from thirty-five to forty moulders on green sand and loam.

It is understood that the traveling crane is unlike the jib crane in many respects; it can't do the work without some little attention; but, on the contrary, if in the hands of an ordinary runner, a good size cope of fifteen or twenty tons, with a large pocket on one end, can be lifted off and turned over with a two-trolley traveler, while the necessary chains are being placed on the hand jib crane. Another advantage of the two-trolley crane is in handling taper flasks. To illustrate this more clearly, I have taken hold of a taper cope twenty-seven feet long, five and



Cupboard for Milling Cutters.

one half and three and one-half feet respectively at the ends, and twelve inches deep, lifted it off the drag with two trolleys, lowered it on the necessary blocks, and turned it over with one trolley in four minutes. Now I think it safe to say that, with a jib crane or two, taking into consideration the number of men at each crane, that doing the above named work would consume from fifteen to twenty-five minutes.

One great advantage of two cranes with two trolleys each, over two cranes with one trolley each, if the foundry is wide enough to permit of two trolleys, is this: Suppose two cranes of one trolley each are to lift a long cope, the latter to be set at right angles to the two bridges or cranes, and there are four or five moulders waiting for a lift; their only remedy is to wait; as it takes longer to make the same lift with two cranes than with one. With two cranes with two trolleys each, and flask set parallel with the cranes, one crane could handle the flasks while the other crane is attending to the four or five moulders in waiting.

A few weeks since I had occasion to lift a 32-ton casting from the pit, which was about seven feet deep, with a crane of 30 tons capacity, two trolleys; I put on the chains and started to hoist it out of the pit at a speed of 10 feet per minute, and then carried it horizontally about 20 feet at the rate of two hundred feet per minute. I next lifted out the loam plate and bricks, and the pit was ready to be filled up. For ordinary work I use two $\frac{3}{4}$" two-leg chains on one trolley and two $\frac{9}{16}$" two-leg chains on the other trolley, so there is no changing of chains except in extreme cases. Charles F. Barnhurst.

Wants to Know How to Straighten Grate Bars.

Editor American Machinist:

The last paper by "Jarno" especially interested me, as I was trying to straighten cast-iron grate bars $\frac{3}{4}$" diameter by 7' 6" long. They are six-sided, and carry a number of pieces, which, by revolving, break up the clinker. These bars frequently bend, which prevents them from being revolved. The bend is too much to be taken out by pening. I tried heating the bars to different degrees of heat, and using a screw press slowly, but the bars invariably broke. I suppose if I could apply the same heat continuously, as they received when working, they could be straightened. I would like to have the experience of the readers of the American Machinist on the subject, which would much oblige

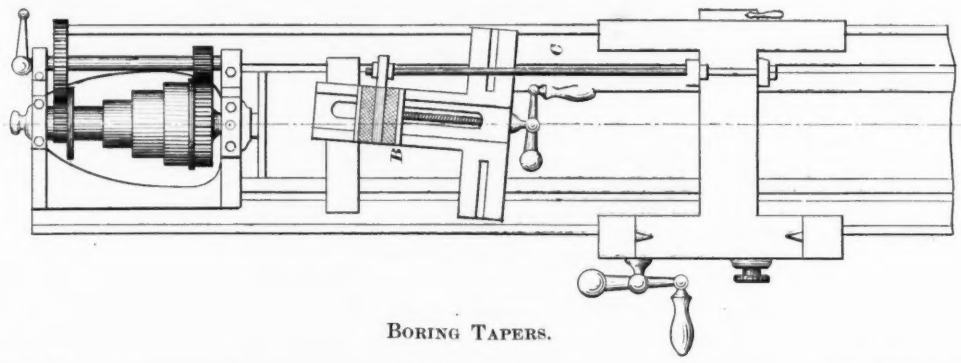
Francis Carroll.

New Orleans, La.

Rig for Boring Tapers.

Editor American Machinist:

Various devices have been shown in the American Machinist from time to time for enabling tapers to be turned and bored on lathes having no special provision for that kind of work, and consequently I have thought that the method shown by the accompanying sketch might prove interesting. The tool-maker in the shop in which I work—Mr. Henry Townsend—bores out a certain plug valve used on the engines built here, this hole being taper. He has a small lathe which has a "rise and fall" rest pivoted in front, and adjusted by a screw at the back. He removed the top part of this carriage, leaving the saddle in position on the shears as shown. The part removed is placed on the shears, and fastened at the proper angle to bore the required taper, the measurements for setting it accurately having been determined and noted. The cross-feed screw is disconnected from the tool-block, which is connected with the saddle by the rod *C*, as shown. Now the tool-block is moved by the carriage, and an automatic feed is obtained from the regular carriage feed. Of course this is not as convenient as a regular taper attachment, nor as good, but nevertheless it answers the purpose, and avoids getting "stuck," and thereby accomplishes its object.



Boring Tapers.

Richmond, Ind. T. H. Miller.

Improved Protractor.

The accompanying cut represents a new form of protractor, which has been devised to do away with the annoyance and inaccuracy always met with in the use of the ordinary protractor and sliding triangles, when laying out work at an angle with the T square.

The distinguishing feature of the instrument is the two *ruling edges, at right angles to each other*, upon the piece *B*, so that as the frame *A* rests against the T square, and *B* is turned about the pin *C*, through 90°, one or the other of the ruling edges of *B* will direct a line at any angle to the T square, from 0° to 360°, while *at the same time* the perpendiculars to these lines may be drawn, without re-setting the instrument, thus affording a great convenience, and one constantly called into play, as every draftsman is well aware.

This feature is also found particularly useful in laying out lever motions, and cam work, as a radius and tangent are given at the same time.

Improved Protractor.

By means of a stop *D*, and suitable notches in the piece *B*, the instrument is readily converted into a 30° and 60° triangle, right or left-handed, or it may be immediately set for right angles to the T square. The small notch in *B* is for a 6° angle, and is very convenient in drawing hubs and rims of wheels, bosses, etc.; any other angle less than 30° may be substituted, however.

A spring underneath the frame holds the piece *B* at any angle, while a set-screw is used to give additional security when desired.

The instrument is made of hard rubber, with 6" ruling edges, the angles being read from an arc of German silver, graduated to $\frac{1}{2}$ degrees, and is manufactured by D. J. Kelsey, 31 Insurance Building, New Haven, Conn.

Test of India Ink, and Hints in Regard to its Use.

The question, How can we select good India ink? often presents itself to those who are about to take up the study of mechanical drawing. Our object in this article is to answer this question, and give some hints in regard to the use of the ink. Our remarks relate only to black ink.

In using India ink it must flow smoothly through the drawing pen, so that an even or unbroken line of any degree of fineness can be drawn; any grit in the ink will cause the lines to be broken, and often gives them a ragged appearance, and these annoyances become more marked when an attempt is made to draw fine lines. Hence, in selecting ink, the following tests should be made: Rub the ink on the wetted end of a finger; if it is good ink it will immediately produce a dense black spot, and while wet it will have a smooth, bordering on an oily, feeling; if there is a rough or gritty feeling, the ink should be condemned. When the spot becomes dry it should have a brilliant luster; a dull appearance indicates a poor quality of ink, which is often worthless.

Lines drawn with good India ink simply lie on the paper; the ink does not eat into it; this property is very desirable, because, if the ink does eat into the paper, neat erasures, when necessary, are impossible. But, to give the ink a practical worth, some adhesive substance is mixed with it during its manufacture. Hence, all India inks possess, to a more or less degree, an adhesive power. Good ink possesses a great adhesive power, and is determined by the following test: Draw a broad, black ink line on paper, and when dry apply the India rubber in the same way as is done in erasing a pencil line. Under this test the line must remain black and continuous, and

not show signs of injury. The line, under this treatment, may lose some of its luster, but this is not objectionable so long as the line remains black. Ink which cannot stand this test should not be used, because it is very annoying to lose or injure some of the lines in cleaning a drawing, which will happen if poor ink has been used.

The next test is with the ink eraser. Erase a part of the line; if this can be done with comparatively very little injury to the paper, the ink is good; otherwise, it contains some substance which acts chemically on the paper, and therefore the ink is unfit for use. Of course, in these tests, the best kind of drawing paper should be used.

Good black India ink will form a perfect emulsion; when properly mixed it will not deposit a sediment, and, if allowed to evaporate, it will become more viscid. It may also be remarked that the better grades of ink, when wet, have an odor of musk.

For all line drawings the ink must stand the foregoing tests; if not, disappointments are sure to follow.

For drawings which are to be tinted, the ink must stand another test, which is by no means the least important one; we shall refer to it presently. Of course, in selecting ink it will not always be convenient to make all these tests in the store, but the first-mentioned test can, and should always be made before buying the ink, and, if satisfactory, and besides this it has an odor of musk, there is a reasonable assurance that the ink is good. The other tests should be carefully made in the office, and if the ink cannot stand these tests it should be condemned.

For mixing the ink use saucers made for the purpose; they are generally sold in nests containing six, each one forming a cover for the other with the exception of one, which forms a cover for the nest, and, when they are placed on top of each other, form a cylindrical pile about 2½ inches in diameter. China dishes are to be preferred to those made out of slate, because the former have smoother surfaces upon which the draftsman usually rubs the ink. The reason for this will be presently seen.

To mix the ink, rub the end of the cake on the bottom of the saucer containing the required amount of pure water, until the emulsion has the required density. The density should be such as to produce very black lines; these lines will generally have a luster when dry, provided the ink is good; the less the luster the less the density of the ink. In a general way, it may be said that the degree of luster of the line when dry indicates the degree of density. If the density is too great, the ink will not flow freely from the pen, which, of course, is an objection.

If the surface of the saucer upon which the ink is rubbed is rough, it will act like a file, and the emulsion will contain small parts of solid ink, which are very annoying in inking, as they will also prevent a free flow of ink through the pen.

For drawings which are to be tinted or shaded with the brush, the emulsion of ink should not be of so great a density as that used for simple line work; the density should be such as to produce lines without a luster, so that they will not wash out or blot when the wet brush is passed over them. This leads us to the last and important test of India ink.

Draw on paper a medium fine ink line, and when dry pass over it a wet artist brush; if the line does not wash out or blot, the ink is good, otherwise it should never be used for drawings which are to be shaded, in fact, any ink that will not stand a wet brush under the given conditions should not be used for any kind of drawing. The test line should not be a broad line or a line with a luster, because such lines, even if drawn with the best kind of ink, are liable to wash out, or blot more or less when touched with a wet brush. All that is needed is that fine lines should not wash out; for, in brush shaded drawings, all lines excepting the shade lines should be fine, and comparatively light in color. The shade lines should be put in after the drawing has been shaded.

In preparing the ink for shading with the brush, the cake of ink should be rubbed on the end of a wet finger, and this in turn should be rubbed on the bottom of the saucer; the cake should never be dipped in the water. The reason for this precaution is to avoid a deposit of flakes or solid ink in the water, which, if not avoided, will lodge on the brush, cause a spot on the drawing, and in some cases may effectually ruin the appearance of the drawing. In fact, this latter mode of mixing ink should in any case be preferred to that of rubbing the ink on the bottom of the saucer, because immersing, and keeping the ink in water until a sufficient quantity has been mixed will soften the cake, cause it to crack and throw off solid particles and flakes in the water, to the great detriment of the easy flow of the ink through the pen. Yet mixing ink is very irksome to the draftsman, consequently the quickest instead of the best way is often employed. After a sufficient quantity of ink has been mixed, the cake should be wiped dry with a soft piece of paper, and not with a rag, because, using the latter, some of its fibers may adhere to the cake, and when the cake is again used these fibers will collect in the water, to the great annoyance of the draftsman.

Cleanliness is of the greatest importance; the dish must be clean, the water pure, and the ink free from dust; and the ink, when mixed, must be kept covered, not only to prevent the dust from flying into it, but also to prevent its evaporation, which will soon cause the ink to become too thick, and unfit for use.

In making a tracing, trouble is often experienced with the flies eating the ink lines. To avoid this trouble as much as possible we have found it to be advantageous to use only fresh mixed ink, and have often rubbed up fresh ink twice a day. Yet, even with this precaution the trouble will not be wholly avoided, therefore the tracing should be kept covered as much as possible.

The best of ink is not exactly waterproof, consequently, if lines on tracing cloth come in contact with a moist hand, they are liable to smutch; the moisture will also injure surface of the tracing cloth. Good draftsmen avoid touching a tracing with moist hands, and keep the tracing well covered, excepting that portion on which they are at work.

We do not recommend liquid ink sold in bottles; we have the same opinion of it as expressed by Prof. MacCord in his book on Practical Hints for Draftsmen. The bottles, when properly cleaned, are good, which is more than can be said of the contents. Some draftsmen speak highly of certain kinds of liquid ink, but we have failed to find any giving results as satisfactory as can be obtained with good India ink properly mixed.

Ordinary writing ink should never be used for mechanical drawing. It is injurious to the drawing pen, eats into the paper so that neat erasures are impossible, and does not give that pleasant appearance to the drawing as India ink will do.

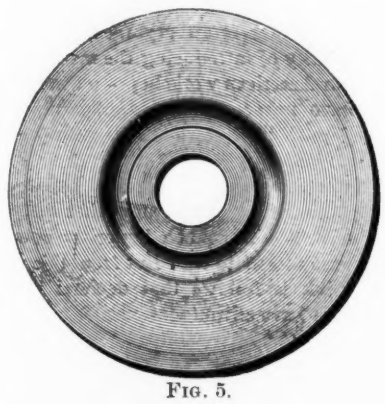


Fig. 5.

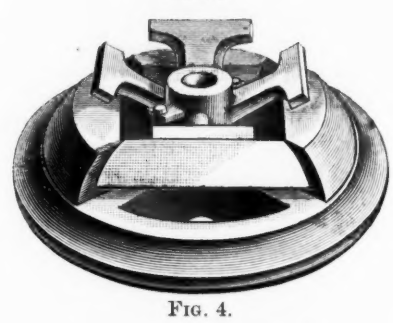


Fig. 4.

Pulsator Steam Pump.

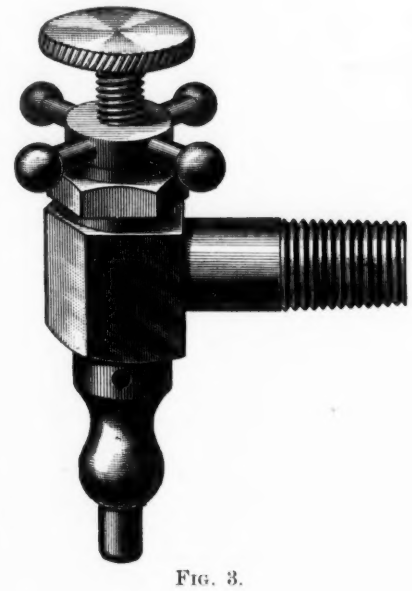


Fig. 3.

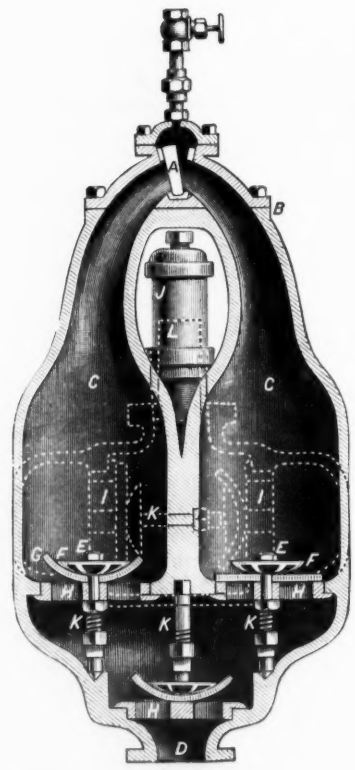


Fig. 2.

Maslin's Pulsator Steam Pump.

The accompanying illustrations show the appearance and construction of a pump built by John Maslin & Son, 165 First street, Jersey City, N. J.

It is constructed upon the same principle as the Pulsometer, with the method of operation of which many of our readers are familiar, though a brief description of its action will not be out of place here. The pump consists essentially of two chambers, designated *C* in the sectional cut, which are alternately filled with water, from which it is forced by the direct pressure of steam, which enters at the top through the steam pipe shown. The valve *A* swings from side to side, and alternately opens and closes the chambers *C* to the passage of the steam. The method of operation is as follows: Supposing the right-hand chamber *C* to be nearly filled with water, above which air has been admitted by the automatic action of a small air-valve shown by a separate cut. By this air the steam is prevented from coming into direct contact with the water, and the consequent condensation is avoided. The pressure thus put upon the surface of the water forces it through the valve *I* (shown in dotted lines) to the delivery. As soon as the water falls in the chamber to the valve, the steam starts to pass through it, and, becoming at once thoroughly mixed with the water, condensation takes place, a more or less complete vacuum is formed, and the valve *A* is swung over by the atmospheric pressure in the left-hand chamber. At the same time the pressure in the delivery pipe closes the valve *I*, the valve *F* opens, and the chamber again fills with water drawn through the suction pipe *D*. While this chamber is filling the other one is being emptied, and thus a practically continuous stream is delivered. It will be seen that there are no moving parts which are subject to much wear or require lubrication.

All valves are easy of access, hand-hole plates being provided for this, which seat upon the inside the same as those used upon boilers, and are held in place by a single bolt and nut. All the parts subject to wear are made interchangeable, and can be replaced by any one very quickly.

The vacuum chamber *J* is of wrought-iron pipe, and is connected with the foot-valve chamber below the valves *G* and *F*. The air-valves before referred to are screwed one into each of the chambers *C*, *C*, and one into the vacuum chamber *J*, their stems hanging downward. *K*, *K*, *K*, *K* are bolts having double square-headed brass nuts attached, and are used to hold the induction and discharge valve-seats, with valves and guards attached in their places. The plug in the top of the vacuum chamber is used for charging the pump when necessary, and means are provided whereby the pump may be readily drained when there is danger of bursting. Any of the valves can be readily reached for examination, cleaning or renewal, by means of the hand-hole plates, and the valves are of a peculiar shape—more flexible at the center, to admit of full opening at each pulsation. The induction and foot-valve seats, being placed horizontal, have the maximum effect of gravity in seating which insures quick action. They are built in sizes having a capacity from 60 to 2,000 gallons per minute.

These pumps are especially well adapted to pumping dirty or gritty water, or for any purpose where pumping is to be done, and are best adapted to pump against heads of 30 to 90 feet, according to size.

The cut, Fig. 3, shows the air-valve spoken of, there being three of these on each pump. It has no delicate parts liable to derangement, admits of firm adjustment while pump is running, and when adjusted can be securely locked in position.

Fig. 4 is what is called "Maslin's maltese valve," which is used in these pumps for contractors' work, and for all purposes where the water or other liquids pumped contain matter which would interfere with the action of such valves as are ordinarily used. The rubber is in sections, the one towards the observer being shown raised from its seat.

Fig. 5 is the improved form of flat rubber valve used, and which tests have shown give a better opening, and are much less liable to crack at the center, than the ordinary plain disk valve.

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New York City and the Electric Wires.

We ventured to suggest when the Board of Electrical Control of New York City was constituted, that, however estimable as men the members of that board were, their lack of knowledge of electrical matters would stand in the way of their usefulness. And it appears to be true that all the way through the long drawn out endeavors of the board to devise means to compel the electrical companies to take care of their wires, the experts connected with these companies have been able to meet and discomfit it at every point. It has been a case of those who knew nothing of the matter at issue attempting to cope with those who were well informed. Just now the city is paying dearly for the custom of appointments made without any reference to special knowledge of the subject connected with the appointments.

All manner of subways for electrical wires have been considered, and now, after a little—not much—progress has been made in the way of getting a few wires under ground, one of the greatest authorities on electrical matters tells, in effect, those seeking information, that the wires under ground are, if anything, more dangerous than those above ground.

The members of the board seem to be quite in the dark as to whether it is or is not possible to insulate a wire, or whether, if so insulated, it will remain in that condition; and they are equally in the dark in regard to other things connected with the use of electricity. Pretty much all the energy expended by the board—and no doubt the members have expended a little—seems to have been useless, because misdirected. Electricity, as taught in the village academy, and electricity as applied to lighting cities, are different in degree.

The citizens of New York have been very patient under the nuisance of the forest of wires in the streets, with their constant menace to life and property. But the wholesale killing of the past six weeks, with the horrible detail of roasting the victims in the air, has exhausted their patience, and they are ready to back Mayor Grant in any measures he may take to force the electric companies to make their wires safe. If it is not possible for the companies to do this, then high-tension wires should go.

It was a mistake in the first place to assume that the city was bound to show the electric companies how to make their wires safe. The city does not feel bound to find a safe means of transporting high explosives through Broadway. It provides that such explosives shall not be transported through its thoroughfares. Unless the electric companies can demonstrate that high-tension wires can be made safe, then the city should take similar action in regard to them.

It should not, however, be concluded that the electric companies have no rights in the matter, or that those companies that use one kind of current should be subordinated to those that use some other kind. The assertions of prejudiced experts should be considered with due allowance. All the people demand is that electric wires of every kind shall be made safe, or be abolished. And there should be no temporizing in regard to this demand. But in getting down to a condition of safety, injustice should not be done. The public is justly indignant over the actions of some of these companies, but two wrongs will not make one right.

The need of increased facilities for travel between this city and Brooklyn is daily becoming more apparent, and the talk of holding a World's Fair here in '92 brings the subject of the necessity for providing it prominently before the public. It has been proposed to lay additional tracks for cable cars over the bridge, but Colonel Roebling declares that this can only be done by doing away with the footway—a thing which we think the people of the two cities should never consent to. This is one of the most magnificent promenades in the world, and, besides, is of untold value as a breathing place for many of the inhabitants of the over-crowded lower parts of the city. To increase the load upon the bridge beyond what it was designed to bear will be something which we hardly think any prudent engineer would think of doing, especially against the protest of its designer. Better build another bridge further up the river, where increased facilities for crossing are needed, and where sooner or later a bridge will have to be built anyway.

Decimal Measurements.

Amongst the Letters from Practical Men, this week, will be found one in which exception is taken to some of our statements made regarding decimal systems of metrology. We hasten to assure our correspondent that we have by no means forgotten the paper on the metric system, by Mr. Coleman Sellers, to which he refers, but beg to remind him that that paper is an argument against the advisability of introducing the metric system into our American workshops—a thing which we have never thought of advocating, and which we believe to be entirely impracticable. We do not believe in the practicability of throwing away all our present standards of measurement in favor of any other system or standard, however much better the new system might seem to be. But from this we do not think it follows that decimal systems may not have advantages peculiar to themselves, or that the tendency should not be towards their use so far as practicable. We do not think that the best possible unit was chosen in the construction of the metric system, and we can see no other reason for its having gained the strength which it has gained, except the fact that it is a decimal system. Whatever of strength it possesses to-day we think is owing entirely to this fact; and that it has attained its present position in spite of the fact that it involved the adoption of a new unit of measurement, by no means the best that could have been chosen, and which turned out to be an arbitrary instead of a natural one, as it was supposed to be by its originators, is one of the best proofs we could possibly have that a decimal system, if not preferable to any other, has at least many advantages which are not to be despised. Decimal divisions of the inch are already quite extensively used wherever micrometer or vernier calipers are in use, and as these tools become more and more common in our machine shops, decimal divisions will become more and more familiar. Tool makers now experience considerable inconvenience arising from the fact that they have usually no means of measuring many of the common sizes in use with a degree of accuracy which is within the practical limits of workmanship, except by estimation. Two different men will scarcely ever set a micrometer at precisely the same place when aiming to set it at one-sixteenth of an inch, or at any other size which involves the estimation of a fraction of the distance between two graduations. This has not interfered with the introduction of micrometers, and their popularity is on the increase. No single line of graduations will give us all the fractions of an inch, which are sometimes or occasionally wanted. There is as much occasion to measure one fifth of an inch as one-third, and while it is true that the decimal system of division will not give us exactly one-third of an inch, neither will the common divisions give us one-fifth, and the argument seems as strong one way as the other. But a scale of decimally divided inches will always measure any fraction whatever, within half of one-hundredth of an inch, being better in this respect than any other single scale to be used for all fractions, while, if it was desired to measure all fractions exactly, different scales would have to be provided for doing it, no matter what scale was commonly used; while, if our iron and steel bars, taps and dies, reamers, etc., were gauged in decimal parts of an inch, to the exclusion of other sizes, it would enable all the commonly used sizes to be measured by micrometers without estimation, and would have many other advantages. It would undoubtedly be productive of some inconvenience while being introduced, and for that reason may never be introduced; but that in nowise alters the fact that it would have advantages when once fairly brought into use. We doubt if very much headway can ever be made towards making the metric advocates see the error of their way by attempting to convince them that the system is intrinsically more cumbersome and awkward than our present one. The strong argument against it is in the utter impracticability of throwing away all our present sizes and introducing entirely new ones based upon a new standard in no respects better than the present one, and in some respects worse. Most of the arguments seen against the metric system are unfair ones, and for that reason are easily upset by the advocates of that system. Mr. Coleman Sellers' argument against it is not open to this criticism, so far as we can see, and is probably the best and most thorough exposition of the subject yet brought out; but it by no means proves that no decimal system, based upon a wisely selected unit, could have advantages over our present one.

A New Trust Scheme.

Some time ago we referred to the especially creditable thing done by the inventor who got up a substitute for jute bagging, just in time to save the cotton growers from the rapacity of the jute bagging trust, and to the opportunity open to inventors in many cases of inventing things adapted to take the place of commodities, the prices of which had been controlled by trusts.

That the efforts of the inventor who got up the substitute for jute bagging are duly appreciated, is shown by the fact that a prominent member of the Farmers' Alliance is to be married in the grand stand of the North Carolina Agricultural Society on the 15th of this month, both he and his bride to be dressed in costumes made of the new cotton bagging, the occasion being made one of general rejoicing over the victory of the cotton growers in their contest with the trust.

It is interesting to note, however, that almost coincident with the announcement of the above event comes the news that the men who have been at the head of the jute bagging trust, have devised a new scheme for evading the anti-trust laws of the various States. This consists of the very simple operation of winding up the affairs of the companies proposing to form a trust, and letting them go out of existence, their property being regularly bought out by a new company, which is to be incorporated in some one State, and thus do all the business formerly done by all the companies entering into the arrangement.

It looks very simple, and as though it could be made to work very satisfactorily—to the members at least.

But we think it might just as well be recognized, first as last, that the people of this country are not going to continue to be robbed by trusts and combinations, and that sooner or later a way will be found to crush them out of existence, no matter how ingeniously they may be arranged. And the greatest danger in connection with the matter is, that the trusts and other forms of organized and legal robberies will continue to be successful so long as to exhaust the patience of the people, and make the final extinguishing operations much more violent and energetic than comfortable.

It is not improbable that the children of the men now engaged in the trust business will live to regret that such things were ever invented, if, indeed, some of the present generation do not have a little experience of that kind.

A Western judge has rendered a decision likely to create a flutter amongst loan companies that have been supplying farmers in that section with money on mortgage at a good round rate of interest. It appears that a good many of these mortgages are dated back before the time of final proof that gives the settler full possession and title to the land, and the Western judge has decided such transactions illegal. Most of these mortgages are of the iron-clad kind, that enables instant foreclosure upon failure to pay the semi-annual interest, and it was on a case of this kind that the ruling of illegality was made and sustained.

Literary Notes.

The American Amateur Photographer is the title of a new monthly magazine, published at Brunswick, Maine. From an examination of the number now before us, we should think this would be exactly the kind of publication amateur photographers—and their name is legion—would want. The price is $1.50 per year.

Questions and Answers

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(392) P. L., Worcester, Mass., asks: Please explain what Mr. Masters means by, "The test bars broken were inch square—corrected to exact size by mathematical formula—and 24 inches long," as stated in your issue of Oct. 3, 1889. *A.*—The test bars were rough, as taken out of the sand, and moulded as near as possible one inch square; but, of course, bars made in this way do not often measure exactly one inch square, hence the results obtained in testing these bars were changed by computation to conform with the results of bars exactly one inch square.

(393) F. M., Cheyenne, Wyo., writes: I find it difficult to make the ink stick to tracing cloth. Will you please inform me of some way to overcome the difficulty? *A.*—With a woolen cloth rub some powdered chalk over the surface on which the ink lines are to be drawn, then wipe the surface clean, and use a good quality of India ink. 2. I would also like to know if there is a machine for describing an ellipse; if so, please describe it, as I have a very good idea of such a machine, and would like to compare it with one made. *A.*—You will find an ellipsograph illustrated and described in our issue of Oct. 20, 1883.

(394) M. D. W., Cincinnati, Ohio, writes: We have four boilers 4 feet 8 inches diameter, 16 feet long, grate surface 25 square feet; three of these boilers are always in use We fire with slack and nut coal mixed. Now, what I want to know is, whether it is better to give one shovel full of coal to a fire at a time, or sufficient to keep the grate bars always covered? Also, which is the most profitable coal to use in an electric light plant? *A.*—The grate bars should always be kept covered; the depth of fire will depend, to some extent, on the quality of coal used and on the quantity of steam the boiler must furnish. The kind of coal you use, if clean, will probably be the most profitable.

(395) A. J. McB., Pittsburgh, Pa., writes: What is the rule for setting the compound rest of a lathe which is graduated in degrees of angle, so as to bore or turn tapers of a given amount to the foot? Common sense teaches me how to set it practically, but I can find no rule for it. For example, how do you find the angle for boring a taper of one inch to the foot? *A.*—Take half the taper per inch, and it will be the tangent of the angle to which the slide should be set. In this case the taper is $\frac{1}{12}$ of an inch per inch, half of which is $\frac{1}{24}$, or .0416 inch. This is practically the tangent of 2° 20′, as found by a table of natural tangents, and that angle of the rest will bore a taper of 12 inches to the foot as nearly as it can be set in that way.

(396) Reader, ———, Pa., writes: I have a shaft with a wheel made fast on each end, and carrying in the center a rope wheel, which is free to turn on said shaft. The hub of this wheel is 7 inches long; the two wheels—one on each end of the shaft—have bearings on a track, and the wheel in the center is kept from lateral movement by two hubs in which the shaft is free to turn. The distance from hub to hub of track wheels is 18 inches. The load on the rope wheel is 6½ tons. The question I wish to ask is: How should this shaft be considered as loaded? *A.*—We should consider the shaft to be a beam simply supported at each end; the distance between the supports being equal to the distance between centers of the treads of the track wheels. The load we should consider to be uniformly applied on a portion of the beam equal to the length of the hub on the rope wheel.

(397) Reader, ———, writes: We are pumping to a reservoir giving us 120 pounds pressure. A distant district which we must supply will only have 60 pounds, and they require for fire protection 80 pounds. This necessitates that we put in an auxiliary pump. Which would be the cheapest in the operating expense—1st, to put a pump at the reservoir where it would have little or no pressure on the suction, or, 2nd, place the pump where it would have about 60 pounds on the suction? We would save about 2 miles of 16-inch pipe by the second plan, if it is practical. *A.*—The second plan is practical, and we prefer it, because it will not only save 2 miles of 16-inch pipe, but it will also require a smaller pump. The cost of fuel saved in running this pump will, in all probability, be greater than the extra cost for labor to run it, unless the quantity of water to be delivered to distant district is very small. On the whole, the second plan seems to us to be the best, and the operating expenses will be less.

(398) "Spindle," New York city, writes: I run a lathe occasionally in which the gear wheel fixed on the mandrel has 42 teeth, while that on the stud into which it gears has 56 teeth. The lead screw has 9 threads to the inch. Will you please tell me how I can find the gears to cut any thread on this lathe? None of the rules seem to apply. What bothers me is the reduction of speed between the lathe spindle and the stud. *A.*—The gears with 42 and 56 teeth are in the same proportion to each other as 9 (the number of threads on the screw) is to 12. In making calculations for the gears, therefore, you can ignore the difference of speed between the spindle and stud by assuming that the screw has 12 threads to the inch instead of 9, and then applying the usual rules. A very good plan when complications of this or any other kind arise, is to place on the stud and screw gears of equal size, and then ascertain what number of threads to the inch the lathe will cut with those gears. This then will be what may be called the effective pitch of the screw, and should be used in making computations for the gears, regardless of what the screw itself measures.

(399) W. G., Camden, N. J., writes: Please tell me how to find the sine of an angle. For instance, in finding the chord pitch of a gear, my book tells me to divide 180 degrees (one-half the number of degrees in a circle) by the number of teeth in the gear, and thus obtain the angle subtended by the circular pitch, then, in a table of natural sines, find the sine of the angle so found, and multiply this sine by 2, and again multiply by the radius of the pitch circle; the product will be the chord pitch. For example: What is the chord pitch of a wheel having twelve teeth, the diameter of the pitch circle being 8 inches? By the foregoing rule we get $\frac{180}{12} = 15°$; the sine of 15° is .25881; hence, $.25881 \times 2 \times 4 = 2.07048$ inches = chord pitch. Now, what I want to know is, how to find the figures .25881 If I had a book which gives the sines of angles, it would be a great advantage to me. *A.*—There are many books which contain tables of natural sines, tangents, etc.; you will find them in any good engineers' pocket book, or in works treating on trigonometry; besides these, there are books published which contain nothing else but tables of this and other kinds. To find the sines of angles without the aid of tables will be extremely tedious, and no one engaged in the ordinary run of practice will attempt to do so. Yet, if you are desirous to know how these signs are found, we refer you to any good treatise on trigonometry.

Business Specials

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday for the ensuing week's issue.

Gear wheels and g-cutting. Grant, see adv., p. 16.

Link-Belting and Sprocket Wheels.
Send for Catalogue of Link-Belting.
Over 50,000,000 feet of Link-Belt in use.
Link-Belt Engineering Co., Philadelphia and N. Y.

Shafting Straighteners. J. H Wells, Tampa, Fla.

Steel Name Stamps, etc., J. B. Roney, Lynn, Mass.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

The best Upright Hammers run by belt are made by Jenkins & Lingle, Bellefonte, Pa.

R. Dudgeon, 24 Columbia st., New York. Improved Hydraulic Jacks and Roller Tube Expanders.

Drop Presses, Punches and Shears. Williams, White & Co., Moline, Ill., manufacturers.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.

Prestoline & Prestoline Paste, for cleaning & polishing metals. S. A. Smith, 23 S. Canal st., Chicago.

Ice and Refrigerating Machines, 131 sold, and all successful. David Boyle, 521 Monroe st., Chicago, Ill.

New Catalogue of Screw Plates, Taps, Dies, etc., just issued by S. W. Card & Co., Mansfield, Mass.

Iron Planers from 16″ to 36″ wide by any length. H. C. Pease & Co., Worcester, Mass.

Patent Attorney. R. G. DuBois, 715 11th st., Wash., D. C., procures first-class patents for inventors.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Most sensitive and durable Damper Regulator made; works within one pound; send for circular. T. Kieley, 11 W. 13th st., New York.

For the latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

The hook on steam engines is being supplanted by the Dill disconnecting device made by the T. C. Dill Machine Company, 726 Girard ave., Phila., Pa.

25″ 28″ 32″ 36″ Upright Drills a specialty. Finely made, great capacity, quickly operated, prices low. Send for list of firms using our Drills. J. E. Snyder, Worcester, Mass.

Eureka Cotton Machine Belting; a cheap and perfect substitute for leather or rubber belting. Address Eureka Fire Hose Company, 13 Barclay st., New York, for prices and samples.

25″ 32″ 37″ 42″ "Only Drill Press built on 'Ko-rekt' principles, even if they come from Jersey." Gould & Eberhardt, New Ark, N. J.

Steam Boilers: Their management and working on land and sea. By Jas. Peattie. Practical facts from 30 years' experience. 230 pages illustrated, 12mo., cloth, $2. Circulars and Catalogue of Books for engineers free. E. & F. N. Spon, 12 Cortlandt st., N. Y

Barnard's Separator, for Separating and Removing Entrained Water from Live Steam, and Condense Water, Oil, Dirt, etc., from Exhaust Steam. Special Design for Surface Condensers. Send for circular and prices. Geo. A. Barnard, 15 Cortlandt st., New York.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and Equipment well adapted for Heavy Steamship Repairs.

H. B. Roelker, 22 Cortlandt st., New York, late Sup't Delamater Iron Works, will hereafter manufacture the Delamater Screw Propeller. Propellers of same pattern and workmanship as formerly made by the Delamater Iron Works. Each designed for its special work at lowest prices. Consulting Expert and Constructing Engineer. Estimates made on machinery and on damages.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Binders" for the AMERICAN MACHINIST. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York.

Manufacturers in metal and wood desiring plain, broad insurance at moderate rate, should address The General Fire Insurance Company (Mutual), 96 Broadway, New York. Edward A. Swain, President.

Patterson, Gottfried & Hunter (Lim.), 146-150 Centre st., N. Y., carry a complete stock of Brush, Copper, Celluvert Fibre, Oiled Paper, Hard Rubber, Rod & Sheet Brass, Brass, Copper & Iron Wire, Self-Hardening Tool Steel, Set & Cap Screws, Machine Bolts, Machine & Wood Screws, Taps & Dies, Files and Twist Drills, Blowers & Forges, Machinery, Tools & Hardware, Gear Wheels, Wood Pulleys, Shafting, Hangers & Belting. General factory supplies.

"Practical Drawing." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, should be closely followed by every student. They commenced with October 23, 1886 issue, and up to and including October 10, 1889 issue, 87 articles have been so far published. Copies containing these articles sent by mail to any part of this country or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

"Modern Locomotive Construction." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, are attracting the attention of railway mechanics all over the world. Commencing with the June 27, 1885 issue, 101 articles have thus far appeared up to and including the October 3, 1889 issue. Copies containing these articles sent by mail to any part of the U. S. or Canada, at 5 cents each AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

Manufactures

D. W. Branch will start a machine shop at Troy, Ala.

The Atlanta (Ga.) Machine Works will be enlarged.

The Pennsylvania Railroad has ordered 40,000 tons of steel rails.

Daniel Beckley will rebuild his paper mill recently burned at Beckleysville, Md.

The Savannah (Ga.) Cotton Mill Co. will rebuild their mill recently burned.

The Mary Lee Coal & Railway Co. will build an iron furnace near Birmingham, Ala.

M. Moran is organizing a company in St. Louis, Mo., to manufacture bolts and nuts.

Alvin Record will build a large paper mill in connection with his pulp mill at Jay Bridge, Me.

A lumber mill will be built at Woodsville, N. H. L. H. Parker is at the head of the enterprise.

The Richmond (Va.) Locomotive and Machine Works contemplate an enlargement of works.

R. N. Oakham is interested in building a factory for silver and plated ware at Greenfield, Mass.

The Stone Knit Goods Manufacturing Company will establish a factory in North Brookfield, Mass.

There is a movement towards erecting a rolling mill at Dunbar, Pa., to make skelp iron exclusively.

The Chase Manufacturing Company will build a toy factory 50x120 feet; also storehouses, at Rutland, Vt

The Felber Machine Works, St. Louis, Mo., will begin the manufacture of a machine for making excelsior.

The Excelsior Foundry, St. Louis, Mo., has been leased by James Mackie. He will make a specialty of fine castings.

A large share of the stock has been subscribed towards building a $200,000 iron furnace at West Lynchburg, Va.

Curtis & Curtis, Bridgeport, Conn., expect to add another building to their works in order to keep up with the demands of trade.

The Cobb County Cotton Mills, of Marietta, Ga., have been incorporated by B. R. Legg, J. R. Winters, B. Montgomery and others.

The Niles Tool Works, Hamilton, Ohio, have issued a special circular. It contains cuts of their planers, with lists of sizes, weights, etc.

The Wisconsin Malleable Iron Company, Milwaukee, Wis., are erecting a foundry 70x300 feet, which will nearly double their present capacity.

The Sweetwater Woolen Mill Co., of Sweetwater, Tenn., which has a capital stock of $50,000, will shortly commence the erection of a woolen mill.

The Board of Trade, of Newton, Kan., has raised $500,000 in money and lands, which will be expended in bringing manufacturing industries to that city.

The Sullivan Timber Company, of Mobile, Ala., will build a saw-mill of 80,000 feet capacity or more, at Wallace, Ala.; also a planing mill and dry kiln.

The Eufaula (Ala.) Cotton Mills are thinking of doubling the capacity of their mill, and manufacturing a greater variety of goods. Capacity now is 5,600 spindles and 180 looms.

The Muscatine Sash and Door Company, which succeeds the Muscatine Manufacturing Company at Muscatine, Ia., has incorporated, with a capital stock of $150,000, all of which is paid in.

The Fort Payne Rolling Mill Company, which is to build a rolling mill at Fort Payne, Ala., has increased its capital stock from $300,000 to $500,000, all subscribed for. Work will soon be commenced.

F. E. Harthan, 4 Summer place, Worcester, Mass., has begun the manufacture of glass triangles for draftsmen, similar to those referred to by Mr. Booth in a recent issue of the AMERICAN MACHINIST.

George A. McArthur, F. W. Thayer and Jas. L. Pennifill have organized the Standard Journal Bearing Co., of Chicago, with a capital stock of $50,000, to manufacture journals and other copper and brass goods.

The Roy Furniture Company has been incorporated, to operate at Charleston, W. Va., by J. C. Roy, Frank Woodman, H. W. Knight and others, for the manufacture of furniture. The authorized capital stock is $200,000.

The Minerva Furnace, at Milwaukee, Wis., has been leased to Forsyth, Hyde & Co., of Chicago, and others, who will organize the Minerva Furnace Co., to operate the furnace. The capacity of the furnace is about 70 tons per day.

W. S. Collins, 171 Broadway, New York, has an order to fit up thirty-six large wire furnaces for John A. Roebling's Sons Co., with the Aerated Fuel Company's system for burning oil. A thirty days' trial was first made of the system.

Advices from Mexico say a Chicago company are building at Linarez, in the State of Tamaulipas, a great sugar refinery, the first ever erected in the Republic. Work on the building is being pushed vigorously. Ten car-loads of machinery have already arrived, and the company has contracted with planters in the vicinity for 10,000,000 pounds of sugar of this year's crop.

Sterling Elliott, Newton, Mass., has issued the second and enlarged edition of his unique catalogue. It contains some mention of machines and machinery made by him, and a good deal in the way of illustration and description calculated to make the soberest laugh. The catalogue, if it may be called such, is labeled "True Inwardness," and every one should have a copy.

The Pratt & Whitney Co., Hartford, Conn., have issued a new and enlarged edition of their catalogue of machine tools, which contains 304 pages, being about twice as many as the old one, and contains illustrations of a great many new machines and small tools. The catalogue is well printed and illustrated, is of convenient size, and should be kept at hand in every machine shop in the land.

There is water-works agitation at Trenton, Ga.; Greensboro, N. C.; Henderson, N. C.; Johnson City, Tenn.; Moscow, Idaho; Fostoria, Ohio; Huntington, Ind.; Ripon, Wis.; Brodhead, Wis.; Kilborne City, Wis.; Ord, Neb.; Genoa, Neb.; Warwick, Ore.; Loup City, Neb.; New Westminster, B. C.; Homestead, Pa.; Little Falls, Minn.; Canton, N. Y.; Dawson, Ia.; Hamburg, N. Y.; Walcottville, Ind.; Huntington, Ind.; Johnson City, Tenn.; Cambridge, Md.; Marietta, Ohio; Northwood, N. H.; Oxford, N. C.

The Tennessee Range and Manufacturing Co., Evansville, Ind., write us: We have just let contracts for our new factory, and expect to move into it within ninety days. Shops will be 50′x270′, three stories; foundry, 50′x125′. Have increased our capital to $100,000. Our specialties will be the manufacture of ranges and erecting steam and water-heating apparatus, and in connection will do a general foundry and machine business, pay particular attention to fine class of work, and manufacturing patented articles for patentees. We are very crowded with work, which forces us to leave our present quarters and go into larger shops.

The nature of the business of the Minnesota Iron Car Co., which has filed articles of incorporation with a capital of $2,000,000, at Duluth, Mich., propose "to smelt iron and other ore, to manufacture pig-iron and its kindred products, railroad cars of all descriptions, locomotives, marine and stationary engines and machinery, iron and steel rails and plates, railroad fastenings, bar iron and forgings of all kinds, and castings of iron, steel, brass and other metals, malleable iron, tubes of iron or steel, metals for structural purposes, and all materials necessary for or incident to the production of railroad equipment and construction, and for any other purpose."

Machinists' Supplies and Iron.

NEW YORK, Oct. 19, 1889.

Iron—American Pig.—No changes of any importance have taken place in the general condition of the market since our last report. We quote Northern brands, No. 1 X Foundry, $17 to $18; No. 2, $16 to $17. Southern brands, No. 1, $16.75 to $17.25, No. 2, $16 to $16.50. Northern brands, Grey Forge; $15.25. Southern brands, $15

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—Traveling salesmen to sell our machine specialties. The Brightman Mach. Co., Cleveland, O.

Foundry foreman, 17 years' exp., desires position. General machinery preferred. Box 37, AM. MACH.

Wanted—Position as mech. draftsman by a young man with practical exp. Address Box 39, AM. MACH.

Wanted—Experienced mech. draftsmen. The Baltimore Sugar Refining Co., Curtis Bay, A. A. Co., Md.

Competent agents wanted to represent a meritorious & paying steam specialty. Business, AM. MACH.

Live Yankee will take shop contracts, or act as foreman under agreement to reduce cost. For particulars address Box 36, AMERICAN MACHINIST.

Wanted—A thorough prac. brass finisher, competent to take charge of finishing dep't. Will make a liberal offer to right man. Essex & Co., London, Ont.

Wanted—Competent draftsman accustomed to locomotive work. State experience and salary, and give references. Locomotive, Box 727, N. Y. city.

Wanted—First-class machinist. Steady work, good pay to the right man. Address, stating work accustomed to, etc., W. E Leard, New Brighton, Pa.

A young man who has worked in a machine shop a year and a half, desires a situation to learn tool making. Student, Lock Box 283, Danbury, Ct.

Wanted—Young man having worked in shop and had some exp. in drawing-room, wishing to further advance himself, will have an opportunity by addressing "Crescent," AMERICAN MACHINIST.

Machinists Wanted—Vise hands accustomed to first-class work. Steady employm't and liberal wages guaranteed. Have largely increased our plant and need more men. Niles Tool Works, Hamilton, O.

Position wanted by young and ambitious machinist and tool maker; experienced in pattern, model and experimental work; some knowledge of drafting and supervising work. Box 34, AMERICAN MACHINIST.

Wanted—Two or three good lathe hands, one man for heavy boring mill; all on piece-work. Liberal pay to good men. Address "Ohio," AMERICAN MACHINIST.

Wanted—At once; a neat tracer who has been accustomed to trace from mechanical drawings in pencil. Apply, giving wages required, to Box 38, AMERICAN MACHINIST.

Wanted—An active, intelligent foreman for machine shop in Western New York; must be able to handle men to advantage. Good position for man of ability. Address, stating age, terms and experience, Box 33, AMERICAN MACHINIST.

Mechanical engineer (a young man) controlling several specialties already on the market, is open to engagement as sup't, having had large experience in handling men and designing machinery. Address "Mch.," AMERICAN MACHINIST.

Wanted—A first-class man, energetic and well up in modern machine shop methods, to take charge of a job employing about thirty-five hands. Concern employs about two hundred men. A man familiar with printing presses preferred. Address Side Rods, AMERICAN MACHINIST.

Wanted—Machinists. A steam engine mfg. shop wishes to put on a full night force of about 100 men—first-class men—for lathes, planers, milling machines, drills, blacksmiths, tool makers, etc. Can secure steady employment and good wages—largely by piece-work. Will work 12 hours each night for 5 nights per week. Address, with references as to capacity and character, Box 841, Pittsburgh, Pa.

We desire to engage the services of two first-class men to take charge of the erecting rooms of our Drill Press and Planer Departments. In addition to being first-class mechanics, they must be live men and readers, who keep themselves posted and abreast of the best and foremost ideas of the times. They must be able to handle men, and possess that rare qualification—executive ability. They will not be hampered, being responsible only to the general manager. The above refers to the manufacture of drill presses and planers, and only those having had experience in the manufacture of these two machines need apply. Study yourself well, and ask some disinterested party, in whom you have confidence, if they think you can fill the bill, before you apply, for we study you well after you apply. The Lodge & Davis Machine Tool Co., Cincinnati, Ohio. Wm. Lodge, General Manager.

✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Cheap 2d h'd Lathes & Drills. S. M. York, Clev., O.

Koopman's Scales for quick measurements.

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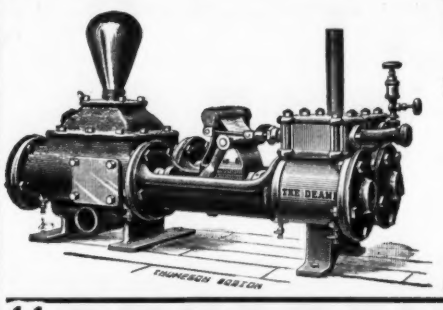

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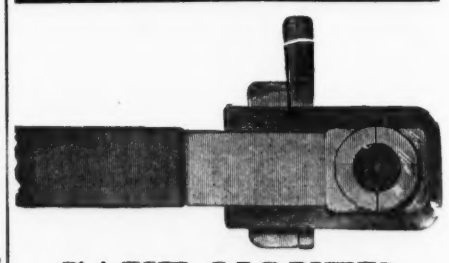

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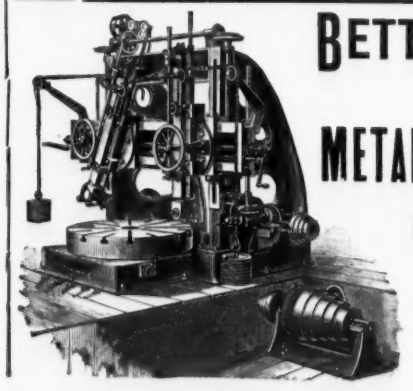

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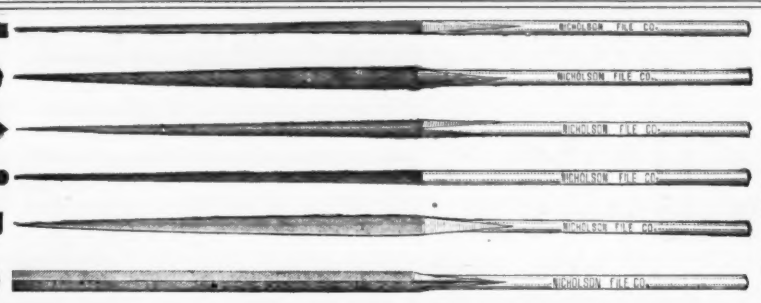

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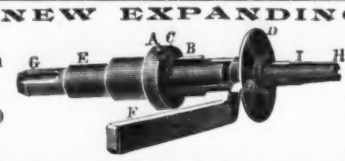

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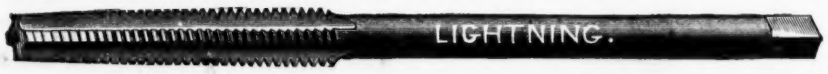

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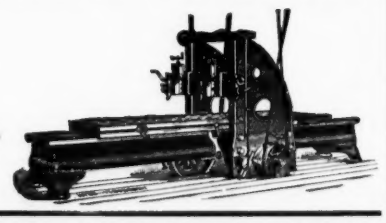

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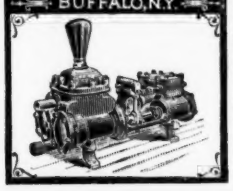

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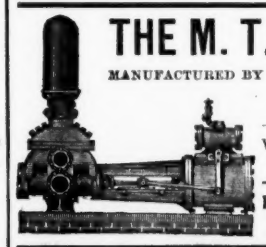

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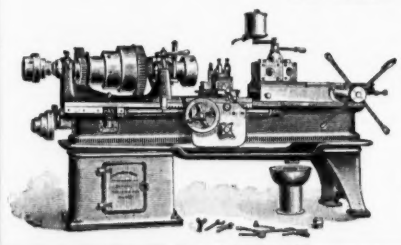

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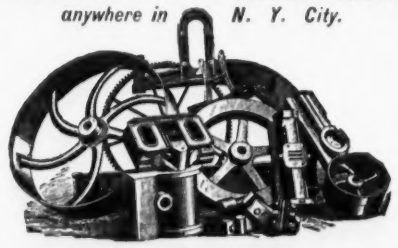

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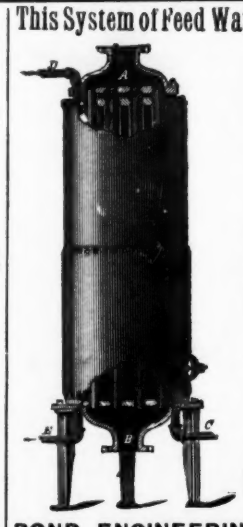

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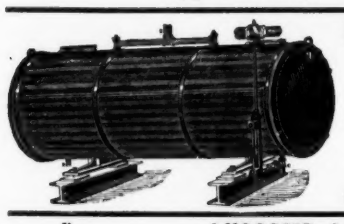

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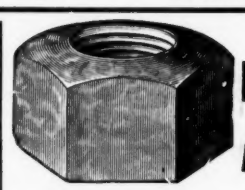

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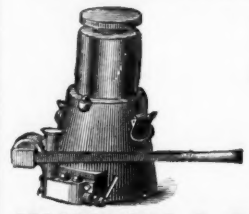

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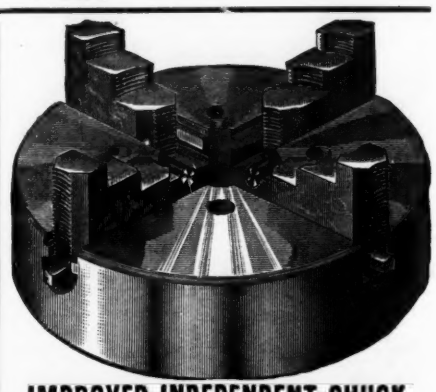

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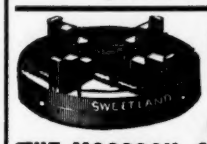

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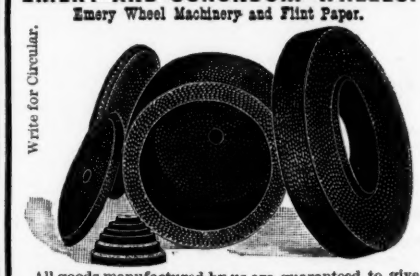

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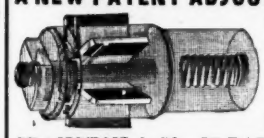

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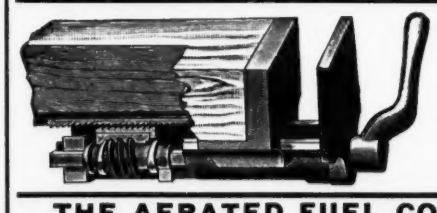

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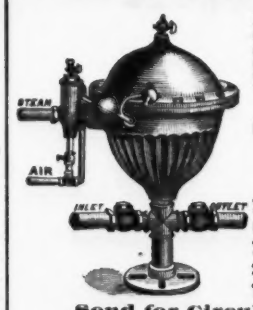

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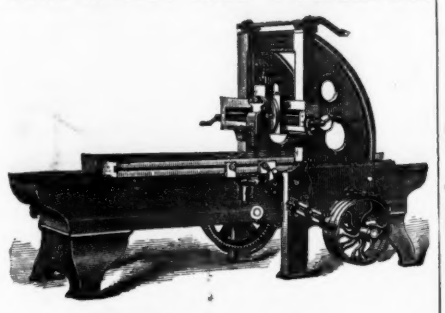

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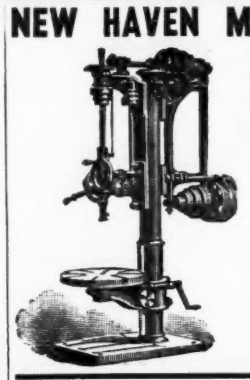

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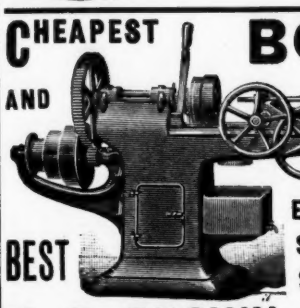

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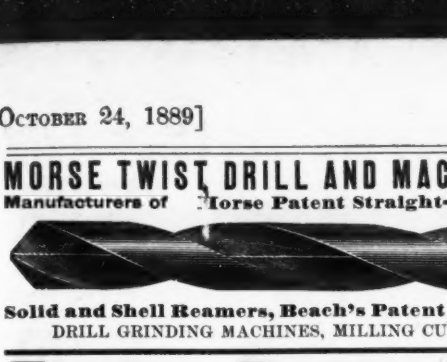

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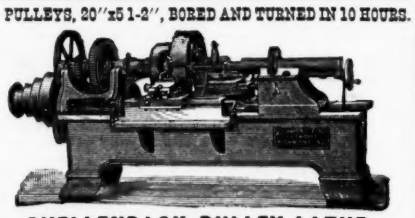

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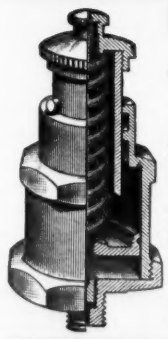

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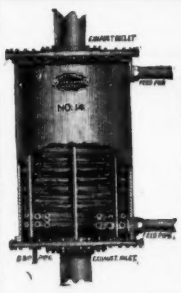

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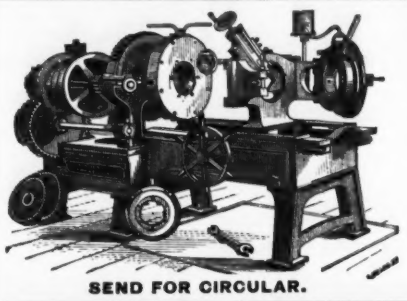

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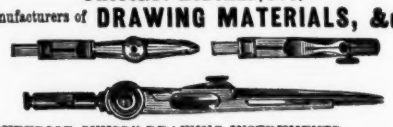

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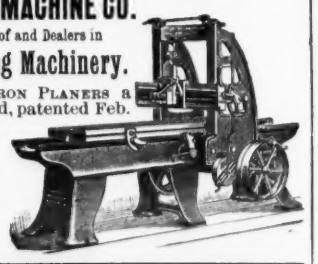

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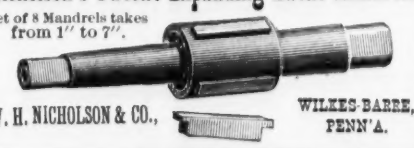

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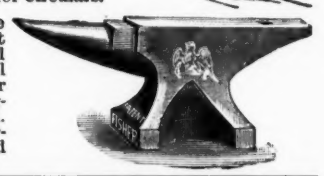

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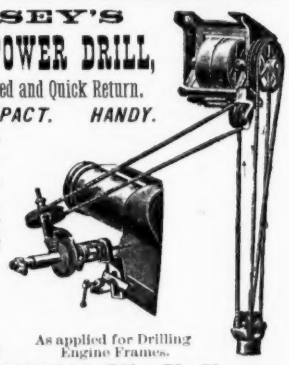

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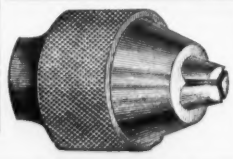

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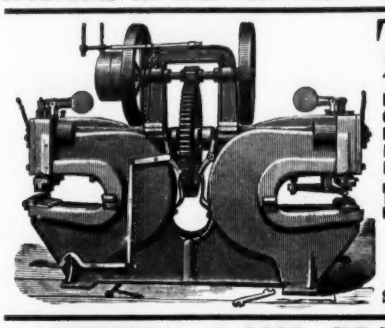

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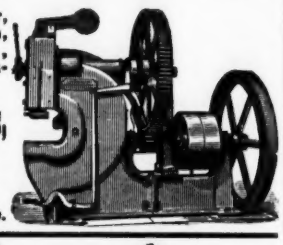

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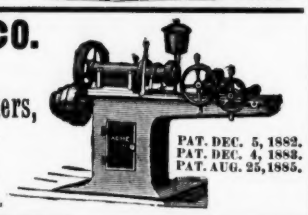

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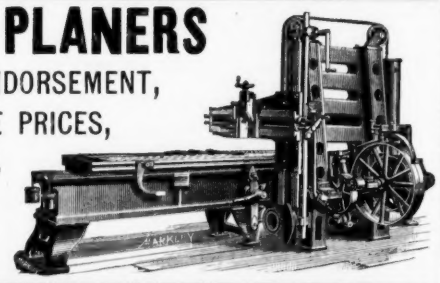

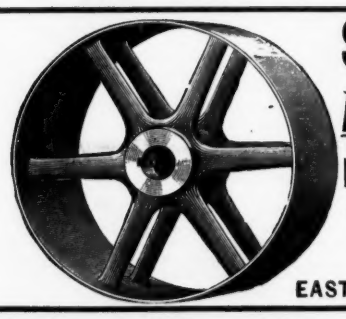

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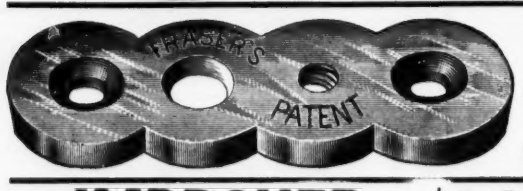

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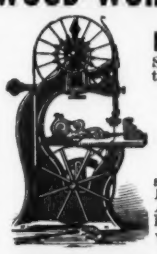

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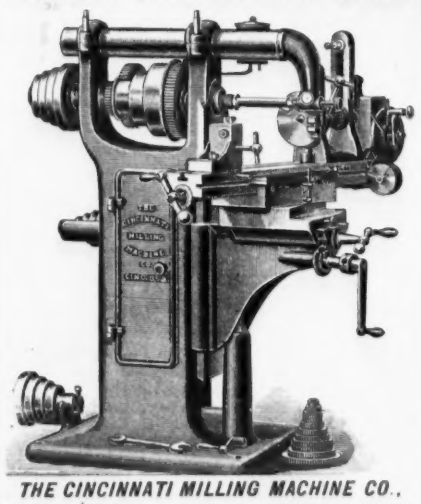

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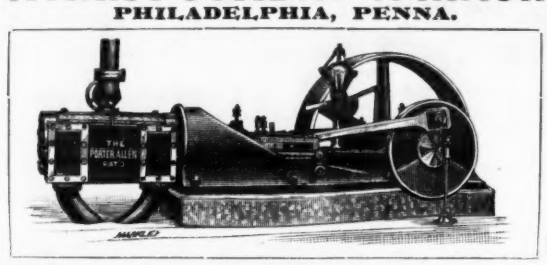

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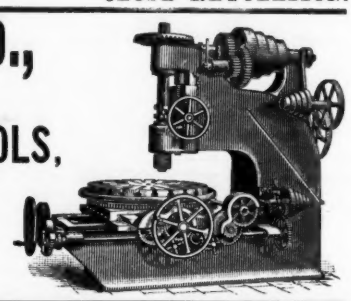

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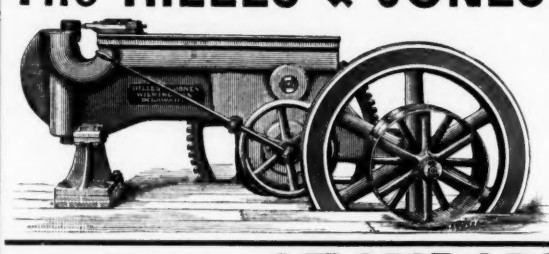

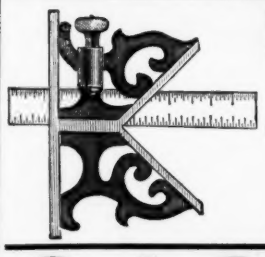

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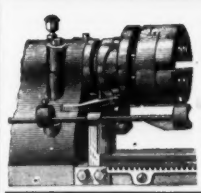

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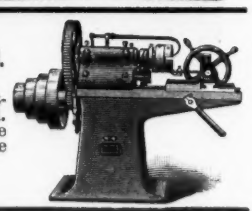

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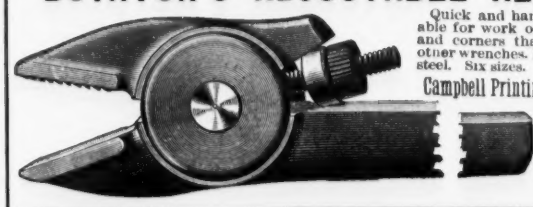

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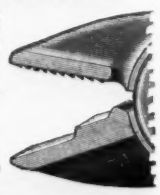

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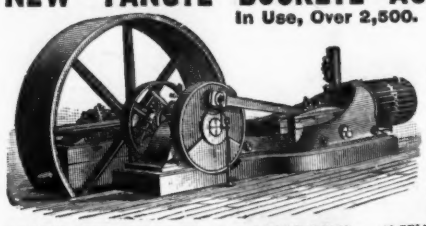

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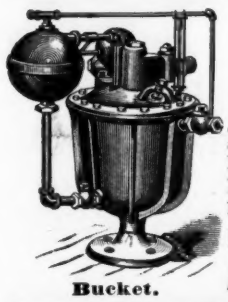

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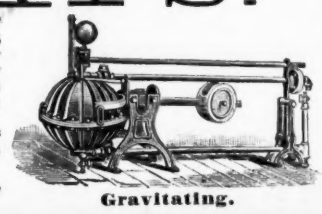

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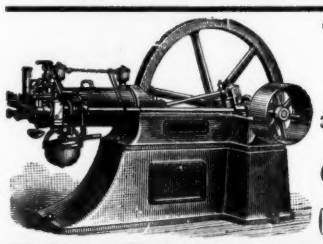

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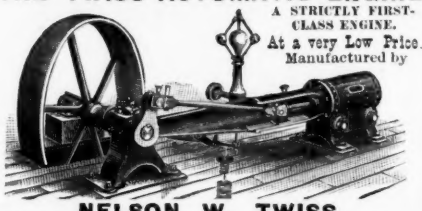

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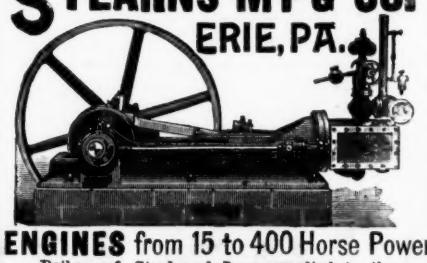

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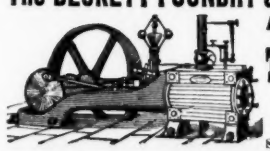

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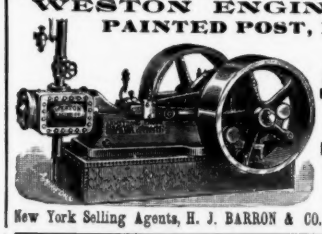

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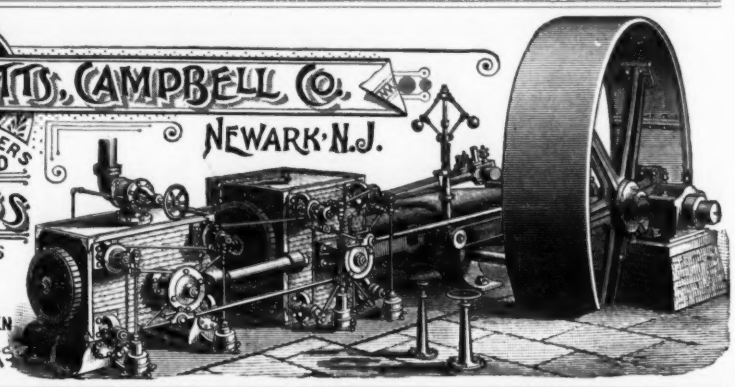

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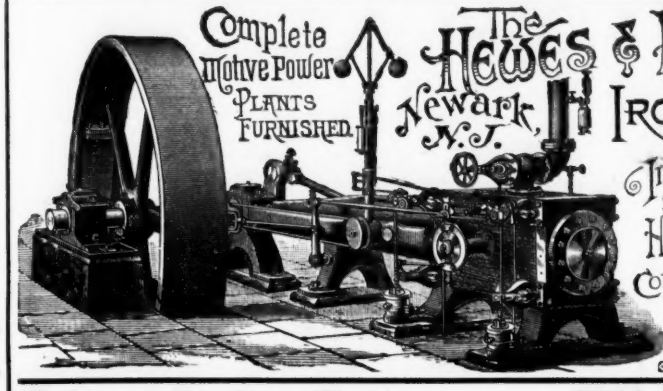

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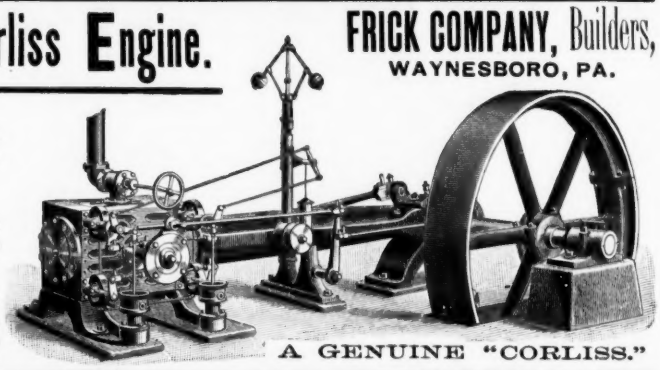

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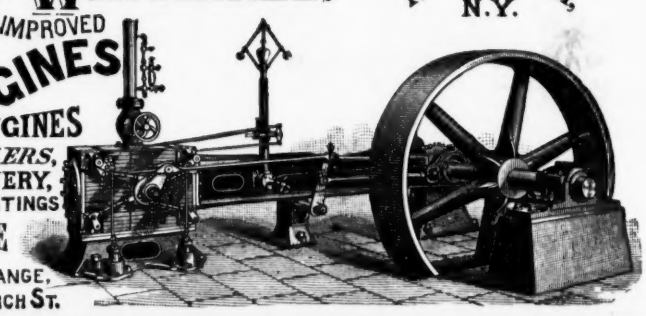

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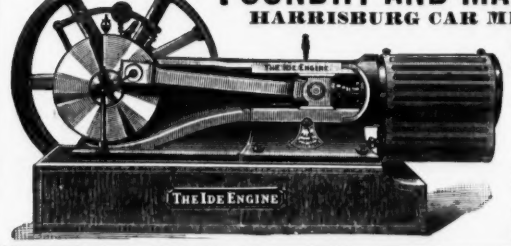

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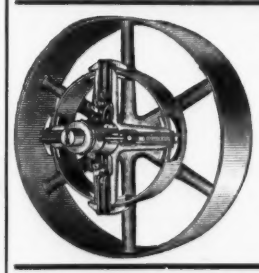

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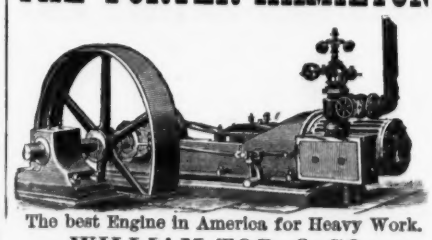

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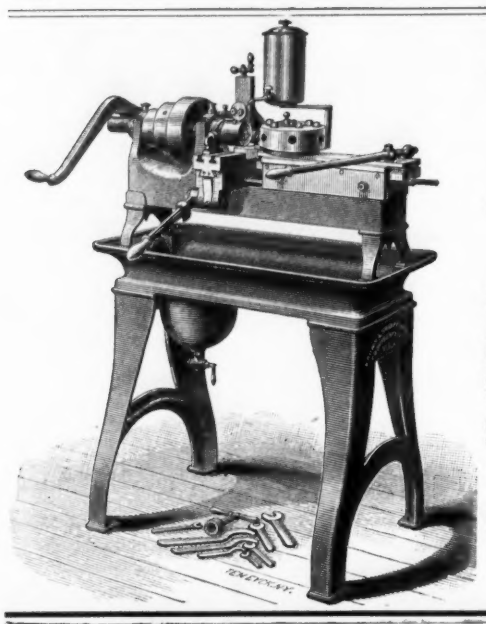

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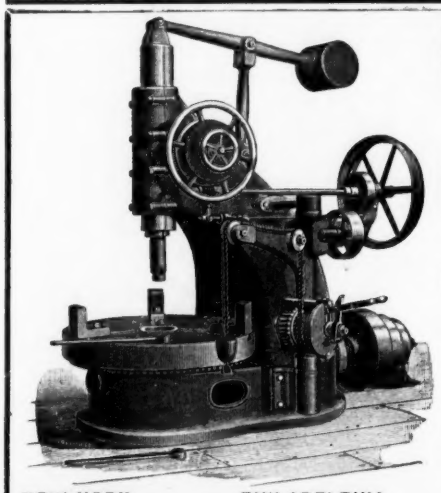

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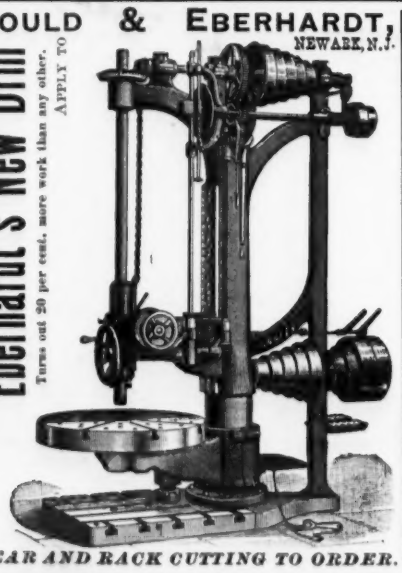

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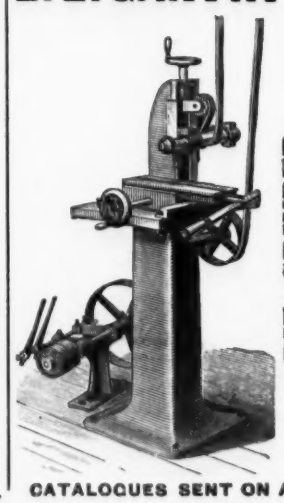

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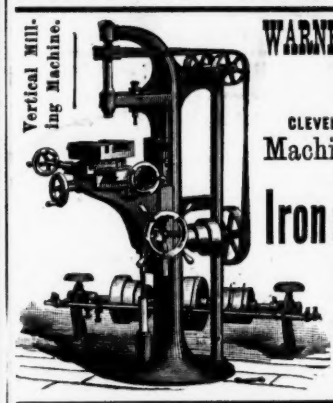

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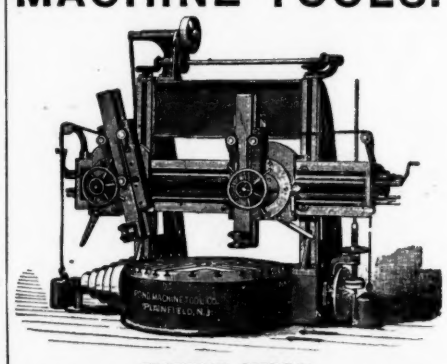

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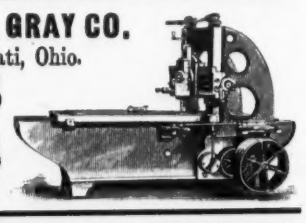

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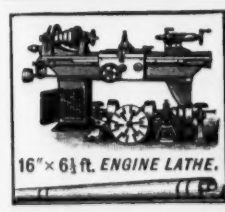

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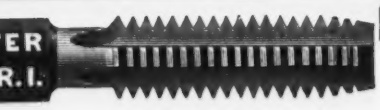

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